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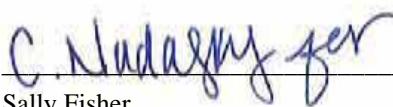
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Regarding: BNSF Oil Pipeline, Tacoma, Washington

Date	Description
7/9/2008	Final Engineering Design Report

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**ENGINEERING DESIGN REPORT
THE BNSF OIL PIPELINE SITE
TACOMA, WASHINGTON**

JULY 9, 2008

**FOR
BNSF RAILWAY COMPANY**

**Engineering Design Report
File No. 0506-141-02**

July 9, 2008

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TABLE OF CONTENTS

	<u>Page No.</u>
ACRONYMS AND ABBREVIATIONS.....	iii
1.0 INTRODUCTION.....	1
1.1 GENERAL.....	1
1.2 PURPOSE AND SCOPE OF THIS DESIGN REPORT.....	2
2.0 SITE BACKGROUND.....	2
2.1 SITE DESCRIPTION.....	2
2.2 SITE HISTORY.....	2
2.3 CONTAMINANTS OF CONCERN AT THE SITE.....	3
2.4 SITE EXPLORATION AND INTERIM REMEDIAL ACTIVITIES.....	3
3.0 SITE CONDITIONS.....	4
3.1 GENERAL.....	4
3.2 SUMMARY OF SITE CONDITIONS.....	4
3.2.1 WSDOT Pond Area.....	5
3.2.2 Nichols Trucking Area.....	5
3.2.3 Home Electric Area.....	5
3.2.4 SuperValu Area.....	6
3.3 NATURE AND EXTENT OF CONTAMINANTS OF CONCERN.....	6
3.3.1 Soil.....	6
3.3.2 Water.....	7
4.0 REMEDIAL ACTION OBJECTIVES.....	8
4.1 GENERAL.....	8
4.2 CONDITIONAL POINT OF COMPLIANCE.....	8
4.3 APPLICABLE STATE AND FEDERAL LAWS.....	9
4.4 SITE CLEANUP STANDARDS.....	9
4.4.1 Soil Criteria.....	9
4.4.2 Groundwater Criteria.....	9
5.0 REMEDIAL ALTERNATIVES EVALUATED.....	9
5.1 GENERAL.....	9
5.2 PREFERRED REMEDIAL ALTERNATIVE.....	10
6.0 REMEDIAL ACTION DESIGN.....	10
6.1 GENERAL.....	10
6.2 SITE-WIDE INSTITUTIONAL CONTROLS AND COMPLIANCE MONITORING.....	11
6.3 REMEDIAL DESIGN – GENERAL PROCEDURES.....	12
6.3.1 Excavation, Backfill and Grading.....	12
6.3.2 Impacted Material Handling and Disposal.....	12
6.4 AREA A – REMEDIAL DESIGN.....	12
6.4.1 Special Considerations.....	12
6.4.2 Residual Contamination – Area A.....	13
6.5 AREA B – REMEDIAL DESIGN.....	13
6.5.1 Special Considerations.....	13
6.5.2 Residual Contamination – Area B.....	14
6.6 AREA C – REMEDIAL DESIGN.....	14

TABLE OF CONTENTS (CONTINUED)

	<u>Page No.</u>
6.6.1 Structural Shoring Requirements	14
6.6.2 Special Considerations.....	14
6.6.3 Residual Contamination – Area C.....	14
6.7 AREA D – REMEDIAL DESIGN.....	14
6.7.1 Special Considerations.....	15
6.7.2 Residual Contamination – Area D.....	15
7.0 SCHEDULE.....	15
8.0 REFERENCES.....	16

List of Figures

- Figure 1. Vicinity Map, Engineering Design Report
- Figure 2. Remedial Areas, Engineering Design Report
- Figure 3. Remedial Area – Area A, Engineering Design Report
- Figure 4. Remedial Areas – Areas B and C, Engineering Design Report
- Figure 5. Remedial Area – Area D, Engineering Design Report

APPENDICES

- APPENDIX A – PLAN SHEETS
- APPENDIX B – SPECIFICATIONS
- APPENDIX C – GEOTECHNICAL REPORT
- APPENDIX D – SAMPLING AND ANALYSIS PLAN
- APPENDIX E – HEALTH AND SAFETY PLAN
- APPENDIX F – COMPLIANCE MONITORING PLAN
- APPENDIX G – INSTITUTIONAL CONTROL PLAN

ACRONYMS AND ABBREVIATIONS

The following acronyms and abbreviations are used in this report:

AO	Agreed Order
ARAR	Applicable or Relevant and Appropriate Requirement
bgs	below ground surface
BNSF	BNSF Railway Company
BRPH	Bunker-range petroleum hydrocarbons
CAP	Cleanup Action Plan
CDF	controlled density fill
City	City of Tacoma
CMP	Compliance Monitoring Plan
COC	contaminant of concern
cPAH	carcinogenic polycyclic aromatic hydrocarbon
CPOC	Conditional Point of Compliance
CUL	cleanup level
Ecology	Washington State Department of Ecology
EDR	Engineering Design Report
FS	Feasibility Study
HDPE	high-density polyethylene
IA	Interim Action
ICP	Institutional Controls Plan
Langseth	Langseth Environmental
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MH	manhole
MTCA	Model Toxics Control Act

PLP	potentially liable party
PVC	polyvinyl chloride
RI	Remedial Investigation
ROW	right-of-way
SEPA	State Environmental Policy Act
Site	BNSF Oil Pipeline Site
SR	State Route
TOC	total organic content
$\mu\text{g/L}$	micrograms per liter
UST	underground storage tank
WAC	Washington Administrative Code
Waterway	Thea Foss Waterway
WSDOT	Washington State Department of Transportation
WSDOT ponds	stormwater ponds constructed by WSDOT as part of the SR 509 overpass construction in the late 1990s

**ENGINEERING DESIGN REPORT
THE BNSF OIL PIPELINE SITE
TACOMA, WASHINGTON
FOR
BNSF RAILWAY COMPANY**

1.0 INTRODUCTION

This document presents the Final Engineering Design Report for the BNSF Oil Pipeline Site (Site) in Tacoma, Washington. Appendices to this report contain the Construction Plans and Specifications for the remedial excavation, the Sampling and Analysis Plan (SAP), the Health and Safety Plan (HASP), the Compliance Monitoring Plan (CMP) and the Institutional Control Plan (ICP). The Site and surrounding area are shown on the Vicinity Map, Figure 1.

1.1 GENERAL

The Site consists of areas in the vicinity of a pipeline that was used to transport bunker oil from bulk storage tanks located north of the intersection of East 15th Street and “D” Street, to what is now the BNSF Tacoma Rail Yard, located south and east of the intersection of East 21st Street and “D” Street. The Site is defined by the Washington State Department of Ecology (Ecology) as the pipeline alignment and adjacent areas, as shown in Figure 2.

Bunker-range petroleum hydrocarbons (BRPH)¹ and carcinogenic polycyclic aromatic hydrocarbons (cPAHs) have been detected in soil and groundwater beneath portions of the Site during subsurface investigations and pipeline closure activities. The BNSF Oil Pipeline (pipeline), underground storage tanks (USTs) located beneath the Site, the Washington State Department of Transportation (WSDOT) ponds and local utility features are all potential sources of petroleum hydrocarbons in the Site area. Ecology has named the BNSF Railway Company (BNSF), the City of Tacoma (City), WSDOT, Home Electric, Inc. (owner of the Tacoma Fixtures property), Nichols Trucking and SuperValu as potentially liable parties (PLPs) for Site investigation and remediation.

BNSF entered into Agreed Order (AO) No. DE 04TCPSR-6034 with the State of Washington to:

- Develop an Interim Action (IA) plan,
- Implement an appropriate IA,
- Complete a Remedial Investigation (RI)/Feasibility Study (FS) at the Site, and
- Prepare a draft final Cleanup Action Plan (CAP) for the Site.

An RI/FS was completed pursuant to the Ecology-approved Work Plan under the AO. A Draft Final CAP was prepared in conformance with the AO to comply with the requirements of Washington Administrative Code (WAC) 173-340-350. The results of the RI/FS are presented in the report titled “Final Remedial Investigation/Feasibility Study BNSF Oil Pipeline Site, Tacoma, Washington,” dated April 4, 2007, which Ecology accepted as final on July 24, 2007. The CAP is presented in the report

¹ BRPH is a site-specific term indicating a Bunker C petroleum product with both diesel- and oil-range petroleum hydrocarbons. The concentration of BRPHs as discussed in this report indicates either: 1) the sum of the laboratory-reported concentrations of diesel- and oil-range petroleum hydrocarbons; or 2) the concentration of petroleum hydrocarbons quantified during analysis relative to a Bunker C product laboratory standard.

titled “Revised Draft Final Cleanup Action Plan, BNSF Oil Pipeline Site, Tacoma, Washington,” dated April 18, 2008 (“draft final CAP”).

1.2 PURPOSE AND SCOPE OF THIS DESIGN REPORT

The purpose of this report is to present engineering design details for the preferred remedial design that will be implemented to address BRPH and cPAHs in soil and groundwater at the Site. The design is based on the draft final CAP, the results of the RI/FS, applicable regulations and our experience with remedial alternatives for BRPH and cPAHs.

2.0 SITE BACKGROUND

2.1 SITE DESCRIPTION

Topography in the Site area is generally flat. The Site area is used primarily for industrial and commercial purposes. Facilities in the “D” Street area include the BNSF Tacoma Rail Yard (transportation), WSDOT (stormwater ponds), Nichols Trucking (trucking), Tacoma Fixtures (fixture manufacturing on the Home Electric property), SuperValu (grocery distributor), Johnny’s Dock Restaurant and Marina, the former Pick’s Cove Marina and J.M. Martinac Shipbuilding Corporation (boat building and repair). The Thea Foss Waterway (Waterway) is located approximately 175 feet to 370 feet west of the alignment of the former bunker-oil pipeline and the USTs that are included in the definition of the Site but are unrelated to the pipeline. The western portion of the Site is located within a designated shoreline zone.

2.2 SITE HISTORY

Development of the area around the Site began in the early 1900s and was associated with construction and use of the Thea Foss Waterway (formerly City Waterway). The Site was initially a tidelflat area where the Puyallup River flowed into Commencement Bay. The tidelflat area (including the Site) was filled with sediments, wood debris, “refuse fill” and other materials as the area was developed.

The surrounding tide flat area has been historically used for industrial and commercial purposes, including lumber milling, coal gas manufacturing, bulk oil storage, shipbuilding, rail and trucking facilities and other uses. The former bunker-oil pipeline appears to have been installed in the early 1900s. The former pipeline appears to have connected oil storage tanks formerly located on property now owned by J.M. Martinac Shipbuilding Corporation at 1501 East “D” Street, with an oil storage tank formerly located on the current BNSF Tacoma Rail Yard property. The storage tank on the Tacoma Rail Yard is reported to have been removed sometime between 1954 and 1969, based on a review of historical aerial photographs. The oil storage tanks formerly located on BNSF property (now J.M. Martinac property) were removed between 1963 and 1965, based on a review of historical aerial photographs and maps.

Portions of the former pipeline located within the Tacoma Rail Yard were removed in the late 1990s during remedial activities associated with construction of the State Route (SR) 509 overpass. Portions of the former pipeline may also have been removed at other locations along the alignment during installation and/or construction of buildings and underground utilities such as City storm drains, sanitary sewers and water lines.

Stormwater ponds were constructed by WSDOT as part of the SR 509 overpass construction in the late 1990s. Construction of these ponds (WSDOT ponds) involved excavation to approximately 10 feet below grade in the immediate vicinity of the contamination.

2.3 CONTAMINANTS OF CONCERN AT THE SITE

The primary contaminants of concern (COCs) at the Site, as defined by the RI/FS and draft final CAP, are BRPH and cPAHs. BRPH is a site-specific term indicating a Bunker C petroleum product with both diesel- and oil-range petroleum hydrocarbons.

BRPH contains cPAHs as part of its composition. cPAHs are high molecular weight PAHs and, for this report, are considered to be benzo(a)anthracene, benzo(b)fluoranthene, benzo(j)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, chrysene, dibenzo(a,h)anthracene and indeno(1,2,3-cd)pyrene. BRPH and cPAHs are referred to collectively as COCs for this report.

2.4 SITE EXPLORATION AND INTERIM REMEDIAL ACTIVITIES

The Site was originally identified in 1997 by Ecology. Site exploration and remedial action activities performed at the Site to date include the following:

- 2001: UST removal at the Nichols Trucking Area. Three USTs (one 10,000-gallon diesel tank, one 5,000-gallon diesel tank and one 500-gallon waste oil tank) were removed from two locations within the Nichols Trucking Area in October 2001 under the direction of Langseth Environmental (Langseth) for Nichols Trucking.
- 2002: BNSF Site Remedial Investigation. Thirty-three direct-push borings were advanced along the former pipeline alignment in March 2002 to evaluate subsurface conditions in the vicinity of the pipeline. The borings completed for the 2002 RI were located within the WSDOT Pond Area, the Nichols Trucking Area, the Home Electric Area and the SuperValu Area.
- 2002: BNSF Pipeline Remedial Activities. Pipeline remedial activities were completed during July and August 2002. These activities included excavating 12 access pits to expose the former pipeline in the WSDOT Pond, Nichols Trucking and SuperValu Areas of the Site. Liquid within the pipeline, including residual product, was removed and transported for off-site disposal. The pipeline was then cleaned and grouted in place in all four areas, including the Home Electric Area.
- 2004 to 2005: Home Electric USTs. Two USTs were known to exist on the Home Electric Area property prior to 2004. One of the USTs was located outside the building near the southwest corner; the other was located inside the building. Home Electric removed the UST located outside the building and closed the UST located inside the building during May and June 2004. Home Electric also completed a geophysical survey to evaluate the suspected presence of a UST (19th Street UST) in the East 19th Street right-of-way (ROW) in September 2004. The survey identified one subsurface “anomaly” in the gravel shoulder of East 19th Street. The 19th Street UST was closed in place during July 2005. An investigation was conducted in 2005 by Robinson-Noble² on behalf of Home Electric after closure of the 19th Street UST.
- 2004: BNSF Interim Action. The IA was completed in July 2004. The objective of the IA was to substantially reduce the potential for BRPH in soil in the East 19th Street area to migrate to the Waterway through the City storm drain system on East 19th Street. Approximately 3,000 tons of petroleum-contaminated soil and wood waste was excavated from the vicinity of the former pipeline and storm drain system on East 19th Street.

² “Tacoma Fixtures Property, 19th Street Underground Storage Tank Closure Report,” by Robinson, Noble, Saltbush Inc., dated October 2005.

- 2004: Storm Drain Replacement and Repair. Isolation and repair of the damaged and leaking City storm drain line in East 19th Street, east of manhole (MH) 394, was completed by the City in August 2004. The work consisted of replacing MH 394 and MH 396, and removing the old storm drain main line from MH 394 to about 300 feet east of MH 396. The old storm drain line was replaced with a new polyvinyl chloride (PVC) storm drain line. Non-functioning laterals to the main line were capped, and piping at the functioning laterals was replaced. A section (approximately 20 feet long) of the storm drain line west of MH 394 was also replaced, and the section between MH 394 and MH 391 was sliplined.
- 2004 to 2006: BNSF Remedial Investigation/Feasibility Study. The soil investigation and first phase of groundwater investigations at the Site were completed in March and April 2004. Additional source characterization and groundwater investigation were conducted in October 2004, with quarterly groundwater monitoring continuing through July 2005. Supplemental groundwater investigation activities were completed in early 2006. Quarterly groundwater monitoring of the wells in “D” Street has continued since 2006.

3.0 SITE CONDITIONS

3.1 GENERAL

The Site is approximately 2,050 feet long and has been divided into four areas (WSDOT Pond Area, Nichols Trucking Area, Home Electric Area and SuperValu Area) for purposes of Site exploration and remedial activities. Four “remediation areas” (A, B, C and D) were subsequently identified during the FS process, and various options for remedial actions in those areas were evaluated during the FS. Area B was divided into two remedial subareas (B1 and B2) as described in the RI/FS and draft final CAP. The remediation areas are shown in Figure 2. The relationship between the Site areas identified in the RI and the remediation areas identified in the FS and draft final CAP is as follows:

- The RI’s WSDOT Pond Area includes remediation Area A;
- The RI’s Nichols Trucking Area includes a portion of remediation Area B2;
- The RI’s Home Electric Area includes remediation Area B1 (the 19th Street UST area), the remainder of remediation Area B2 and a portion of remediation Area C; and
- The RI’s SuperValu Area includes the remainder of remediation Area C and all of remediation Area D.

Additional details regarding these areas are provided in the RI/FS and draft final CAP. During the engineering design process, including preparation of the plans and specifications and a geotechnical report, it was determined to be most prudent and cost effective to combine the two Area B remedial subareas into a single remedial excavation area.

3.2 SUMMARY OF SITE CONDITIONS

Stormwater drain lines are located within remediation areas A, B and C. These stormwater lines discharge to the Waterway via stormwater Outfalls 243, 245, 248 and 249, located as shown in Figure 2.

Subsurface conditions beneath the Site generally consist of 2 to 9 feet of loose to medium dense sand with varying silt content underlain by a zone of mixed soil and wood waste fill. Explorations completed at the Site indicate that the wood waste fill, where present, varies from 2 to 12 feet in thickness and extends to a maximum observed depth of 16 feet below ground surface (bgs). Native sand with varying amounts of

silt exists below the wood waste fill. Wood waste fill was not observed in the subsurface explorations located within or north of East 18th Street.

Depth to groundwater ranges from about 5 to 8.5 feet bgs and is tidally influenced. The direction of groundwater flow is generally westward, towards the Waterway, based on the results of the RI groundwater studies.

3.2.1 WSDOT Pond Area

The WSDOT Pond Area consists of the former pipeline alignment and adjacent WSDOT stormwater retention ponds, as shown in Figure 3. The ponds collect stormwater runoff from the adjacent SR 509 roadway and discharge to the Waterway. WSDOT has indicated that the stormwater ponds are lined with a high-density polyethylene (HDPE) liner.

A City storm drain line crosses the former pipeline alignment beneath an access road south of the ponds and discharges to the Waterway at Outfall 243, as shown in Figure 2. An abandoned City sanitary sewer line also crosses the former pipeline alignment south of the WSDOT Pond Area.

3.2.2 Nichols Trucking Area

The Nichols Trucking Area consists of the former pipeline alignment and adjacent areas on the western portion of the Nichols Trucking property, extending to the centerline of East 19th Street and the centerline of “D” Street.

Three USTs were previously located in the Nichols Trucking Area. These USTs were closed and removed in October 2001 under the direction of Langseth Environmental as described in their 2002 report “Site Characterization Report, Nichols Trucking DOE Site #011950, Underground Storage Tank Removal Project.”

Post-closure remedial activities, including excavation and removal of petroleum-contaminated soil, were completed in July 2002. Results of post-closure investigations are discussed in Langseth Environmental’s report “Final Voluntary Cleanup Report, Nichols Trucking, WSDOE Site ID #011950, Petroleum Contaminated Soil Remediation Project.”

A City sanitary sewer and a storm drain cross the former pipeline alignment beneath East 19th Street at the locations shown in Figure 2. The storm drain line discharges to the Waterway at Outfall 245.

3.2.3 Home Electric Area

The Home Electric Area consists of the former pipeline alignment and adjacent areas on the Home Electric property along “D” Street, from East 19th Street to the northern property boundary, and along East 19th Street from “D” Street east to approximately 75 feet east of the 19th Street UST, as shown in Figure 2.

Three USTs were located on the southwest portion of the Home Electric Area adjacent to and/or inside the Tacoma Fixtures building. These USTs were included in the definition of the Site by Ecology in a letter to Home Electric dated October 15, 2004. Home Electric removed one of the USTs and closed one UST in place in 2004.

The presence and location of the third UST (19th Street UST) was confirmed in 2004, outside of and adjacent to the Tacoma Fixtures building, after a geophysical survey was conducted by Home Electric.

The UST is located within the City's ROW for East 19th Street. The UST was closed in place during July 2005 by Home Electric. Closure consisted of removing 9,429 gallons of oil and water from the tank and filling the tank in-place with 63 cubic yards of controlled density fill (CDF). Inspection of the tank during the closure revealed holes and cracks in the tank bottom and sidewalls. Results of post-closure investigations are discussed in a 2005 report by Robinson, Noble & Saltbush, Inc, "Tacoma Fixtures Property, 19th Street Underground Storage Tank Closure Report."

3.2.4 SuperValu Area

The SuperValu Area consists of the portion of the former pipeline alignment extending north of the Home Electric Area to East 15th Street, including portions of SuperValu parking areas located on either side of East 18th Street.

A City sanitary sewer and a stormwater drain cross the former pipeline alignment beneath East 18th Street at the locations shown in Figure 2. The stormwater drain line discharges to the Waterway at Outfall 248. A storm drain is also located beneath the northernmost SuperValu building. This storm drain discharges to the Waterway at Outfall 249.

3.3 NATURE AND EXTENT OF CONTAMINANTS OF CONCERN

The chemical analytical data for BRPH and cPAHs in soil and groundwater samples obtained during the RI and during previous investigations at the Site were evaluated relative to the selected cleanup criteria to evaluate the nature and extent of contamination at the Site.

3.3.1 Soil

Area A: Area A is located along the east side of the WSDOT ponds, as shown in Figure 3. The western limits have not been fully determined because of the presence of the ponds; it is possible that petroleum-impacted soils extend beneath the ponds. However, Ecology file field notes indicate that the BRPH-impacted soils are primarily to the north and east of the ponds. The concentrations of BRPH in soil in the WSDOT Pond Area range from about 2,520 milligrams per kilograms (mg/kg) to 53,300 mg/kg. The BRPH-contaminated soil is generally located between 5 and 12 feet bgs. It should also be noted that a white powdery substance with a pH of 13 was observed in soil at one test pit excavation completed during a study by Ecology on the northeast side of the pond. The substance was not observed in any of the borings drilled in the area and does not appear to be widespread in Area A.

Area B: Area B consists of the area adjacent to and east of the 2004 BNSF IA area and in the vicinity of the closed-in-place 19th Street UST, as shown in Figure 4. This area is identified in the FS and draft final CAP as Area B1. Area B also includes the area identified in the FS and draft final CAP as Area B2. BRPH have been detected at concentrations greater than the Model Toxics Control Act (MTCA) cleanup level (CUL) in soil in the vicinity of the UST, extending eastward to borings TF-5, TF-7, RI-19 and MW-6. The petroleum-contaminated soil extends to the south side of East 19th Street to the area in the vicinity of RI-16 and RI-17 (the area formerly identified as "B2"). The petroleum-contaminated soil is generally located between 5 and 12 feet bgs. The concentrations of BRPH in soil in Area B range from about 2,214 mg/kg to 40,900 mg/kg. The highest concentrations of BRPH are located near the closed-in-place 19th Street UST. The northern limits of the impacted area have not been fully determined because of the presence of the Tacoma Fixtures building, and it is possible that BRPH-impacted soil extends northward beneath the building. The eastern limit appears to extend to at least MW-6. The contaminated area previously extended westward on East 19th Street to about 20 to 30 feet west of the former pipeline alignment. Most of the petroleum-contaminated soil beneath East 19th Street in the vicinity of the

pipeline was removed during the 2004 BNSF IA. The western limit of the impacted area is now assumed to be the 2004 BNSF IA excavation. The southern limit of Area B is shown in Figure 4.

Area C: Area C is located in the parking areas east of the Tacoma Fixtures and the SuperValu Area buildings, as shown in Figure 4. The area where concentrations of BRPH in soil are greater than the CUL generally extends from borings RI-31 and RI-43 at the southern limit to RI-35 at the northern limit and RI-40, RI-41 and RI-42 along the western limit. The eastern limit has not been fully determined because of the presence of the Tacoma Fixtures and SuperValu buildings, and it is possible that BRPH-contaminated soil is present beneath the buildings. The concentrations of BRPH in soil in the Home Electric/ SuperValu Area range from about 3,210 mg/kg to 31,200 mg/kg. The BRPH-contaminated soil is generally located between 6 and 10 feet bgs.

Area D: Area D is located near the northern boundary of the SuperValu property, as shown in Figure 5. BRPH-contaminated soil was encountered within access pit AP-5C during previous closure activities in the soil immediately above and adjacent to the former pipeline. The contamination was found between about 1.5 feet bgs and 4 feet bgs at concentrations ranging from 13,530 mg/kg to 26,000 mg/kg. Further investigation during the RI indicated that the contaminated soil is located in a very small area near AP-5C and is located above groundwater.

3.3.2 Water

Area A: Monitoring wells MW-1, MW-12 and MW-15 are located in the vicinity of the BRPH-contaminated soil at Area A, as shown in Figure 3. Petroleum hydrocarbons were detected at concentrations greater than the CUL in groundwater from MW-1 only during the January 2005 monitoring event and in groundwater from MW-12 and MW-15 only during the October 2004 and January 2005 monitoring events. The MTCA Method A CUL is 0.05 milligrams per liter (mg/L), and the concentrations of BRPH detected in groundwater from those wells ranged from 0.533 mg/L to 1.35 mg/L. cPAHs have not been detected in groundwater from these wells at concentrations greater than the CULs.

Monitoring wells MW-2 and MW-3 are located in East "D" Street downgradient of the contaminated soil area. BRPH has not been detected in groundwater from MW-3 during any of the sampling events. BRPH was detected in groundwater from MW-2 during only one of the 10 sampling events (October 2004). The concentration was 0.563 mg/L. It appears that the detection at MW-2 is an anomaly. cPAHs have not been detected in groundwater samples obtained from MW-3 during any of the sampling events where analyses for cPAHs were performed. cPAHs were detected in groundwater from MW-2 during only one of the 10 sampling events (May 2006) at a concentration less than the MTCA Method A CUL of 0.1 micrograms per liter ($\mu\text{g/L}$).

The results of the RI indicate that groundwater quality at MW-2 and MW-3 meets the MTCA Method A CUL for groundwater.

Area B: Monitoring well MW-6 is located upgradient of most of the BRPH-contaminated soil in Area B, as shown in Figure 4. MW-13 is located within the backfill of the BNSF IA excavation area located downgradient of the 19th Street UST.

BRPH was detected in groundwater samples obtained from MW-6 and MW-13 at concentrations greater than the MTCA Method A CUL during the October 2004 and January 2005 monitoring events, but was not detected during the other sampling events. The concentrations of BRPH (quantified as diesel-range petroleum hydrocarbons) detected ranged from 0.515 mg/L to 1.02 mg/L. cPAHs either were not

detected or were detected at concentrations less than the CUL in the groundwater samples obtained from these wells during the events for which analyses for cPAHs were performed.

Monitoring wells MW-4 and MW-5 are located in East “D” Street downgradient of the area of petroleum-contaminated soil. COCs were not detected in groundwater from either of these wells during any of the sampling events.

Area C: Monitoring wells MW-7 and MW-14 are located within the BRPH-contaminated soil area in Area C, as shown in Figure 4. BRPH was detected in groundwater samples obtained from MW-7 at concentrations greater than the CUL during the July 2004, October 2004 and January 2005 monitoring events and in samples obtained from MW-14 during the October 2004, January 2005, April 2005, January 2006 and May 2006 events. The concentrations of BRPH detected in groundwater during those events ranged from 0.695 mg/L to 2.87 mg/L. BRPH have not been detected in samples collected from MW-14 during any of the sampling events since May 2006. The groundwater monitoring data are summarized in Table 1 of the “Revised Draft Final Cleanup Action Plan” dated April 18, 2008.

cPAHs were detected at a concentration (0.291 $\mu\text{g/L}$ [total]) greater than the CUL in the groundwater sample obtained from MW-7 during the October 2004 monitoring event. cPAHs were detected at a concentration (0.856 $\mu\text{g/L}$ [total]) greater than the CUL in the groundwater sample obtained from monitoring well MW-14 during the May 2006 monitoring event.

Monitoring well MW-10 is located in East 18th Street, downgradient of the former pipeline. BRPH and cPAHs have not been detected in groundwater samples obtained in MW-10 during any of the five monitoring events, indicating that the northern limit of impacted groundwater in this area does not extend beneath or beyond East 18th Street.

Monitoring wells MW-8, MW-9 and MW-11 are located in East “D” Street, downgradient of the area of petroleum-contaminated soil. BRPH and cPAHs have either not been detected or were detected at concentrations less than the CUL during all of the sampling events at these wells.

Area D: Groundwater was not encountered within the area of contaminated soil in Area D, as described in Section 3.3.1, and therefore no monitoring wells were constructed in this area.

4.0 REMEDIAL ACTION OBJECTIVES

4.1 GENERAL

The remedial action objectives selected for this Site in the FS and draft final CAP are as follows:

- Remove BRPH soil contamination greater than MTCA Method A CULs to the maximum extent practicable.
- Monitor groundwater concentrations of COCs to assess if any migration of these compounds is occurring past the Conditional Point of Compliance (CPOC) for the Site.

4.2 CONDITIONAL POINT OF COMPLIANCE

The CPOC at the Site was identified as the existing wells within the East “D” Street ROW in the RI/FS (GeoEngineers 2007, Section 10.1.2). The CPOC was identified as protective of the Waterway.

4.3 APPLICABLE STATE AND FEDERAL LAWS

Applicable or Relevant and Appropriate Requirements (ARARs) refer to state and federal laws that apply to the remedial action for the Site based on the criteria in WAC 173-340-710(3). ARARs with potential applicability at the Site are provided in Section 10 of the draft final CAP.

4.4 SITE CLEANUP STANDARDS

CULs for the COCs in soil and groundwater at the Site were selected based on current zoning and existing and expected uses of the Site, as presented in the RI/FS.

4.4.1 Soil Criteria

MTCA Method A CULs for soil were selected as CULs for this Site because they are protective of the most conservative future uses of the Site based on current zoning (mixed-use commercial/industrial and shoreline) and are protective of groundwater. The MTCA Method A CULs chosen for this Site are based on unrestricted site use, which Ecology considers the reasonable maximum exposure at sites in Washington and protective of groundwater quality. Applicable soil CULs include:

- Petroleum hydrocarbons (quantified as BRPH): 2,000 mg/kg
- Total cPAHs (determined using toxicity equivalency methodology as required in WAC 173-340-708(8)): 0.1 mg/kg

4.4.2 Groundwater Criteria

MTCA Method A CULs for groundwater were selected for use at this Site because they are protective of the most sensitive future use of groundwater – that is, groundwater that is potable and is, or could be, a source of drinking water. MTCA Method B CULs were selected for COCs where MTCA Method A CULs have not been established (for example, naphthalene). The MTCA Methods A and B CULs are likely overly protective because the Site area is used primarily for industrial and commercial purposes, and because groundwater is not currently potable or expected to be a future source of drinking water.

Applicable groundwater CULs include:

- Petroleum hydrocarbons (quantified as BRPH): 0.5 mg/L
- Naphthalene: 160 µg/L
- Total cPAHs (determined using toxicity equivalency methodology as required in WAC 173-340-708(8)): 0.1 µg/L

5.0 REMEDIAL ALTERNATIVES EVALUATED

5.1 GENERAL

BRPH in soil is the primary contaminant at the Site. Other contaminants (cPAHs in soil and COCs in groundwater) are also present at the Site and are associated with the BRPH in soil. Remedial actions at the Site are, therefore, focused on control and recovery of BRPH.

Remedial actions other than those described in the FS were dismissed from further screening because they were not considered technically possible to implement because of the relatively insoluble/immobile nature of BRPH and the complexity of Site surface and subsurface conditions.

The following remedial actions are considered potentially applicable to BRPH in soil and/or groundwater at the Site and were screened relative to MTCA requirements during the FS:

- No action;
- In-situ stabilization of BRPH-impacted soil;
- Isolation/containment of BRPH-impacted soil with in-situ treatment of BRPH-impacted groundwater;
- Excavation of contaminated soil to the maximum extent practicable; and
- Complete excavation of BRPH-impacted soil.

The remedial alternatives are presented in detail in the RI/FS report.

5.2 PREFERRED REMEDIAL ALTERNATIVE

Excavation of contaminated soil to the maximum extent practicable was selected as the preferred remedial action. The Site is an active industrial and commercial area with complex subsurface conditions and multiple utilities. The data indicate that although most of source material appears to be located in relatively accessible areas, some soil contamination may extend beneath existing buildings. Complete removal of all contaminated soil could therefore involve closure/relocation of active businesses, relocation of utilities and demolition of buildings. Complete removal of all BRPH-contaminated soil at the Site is considered impracticable. The proposed removal activities will focus on removing readily accessible contaminated soil and wood waste where BRPH is present at concentrations greater than the CULs.

6.0 REMEDIAL ACTION DESIGN

6.1 GENERAL

Sloped sidewalls will be used at each remedial excavation area. Appropriate structural shoring will be used at remedial Area C to maximize removal of BRPH-containing soil, to help control groundwater flow into the remedial areas and to protect existing structures adjacent to the remedial area.

Excavated contaminated soil may require temporary on-site stockpiling and dewatering because of the presence of shallow groundwater at the Site. Water collected during dewatering processes will be treated and/or transported for off-site disposal. Restoration of each area will be required after completion of the remedial activities.

Groundwater conditions could be enhanced by placing soil high in total organic content (TOC) as backfill in excavation areas where some residual contamination will remain after remedial activities. The organic carbon in the soil will increase the sorptive capacity and decrease the permeability of the soil and thus reduce the potential for dissolved contaminants to migrate through the subsurface. Impermeable liners and/or backfill (such as CDF) may also be used as appropriate in the base and sidewalls of the excavations to further discourage migration of contaminated groundwater through clean backfill placed in the remedial excavations after removal of BRPH-contaminated soil and wood waste.

Excavation of BRPH-contaminated soil to the maximum extent practicable was selected through the FS as the preferred remedial action. The results of the RI/FS indicate that most of the BRPH-contaminated soil appears to be located in areas that may be removed while using sheet piles or other support systems for excavations near roadways and buildings. However, some contamination may extend beneath existing

buildings or roadway structures. BRPH-contaminated soil located in the proximity of active utilities may also be left in place. It is not possible to precisely estimate the location and amount of contaminated soil that will be left in place because the precise limits of contamination have not been fully delineated. The areas where BRPH-contaminated soil may remain after the remedial action are described in the following sections.

Construction drawings showing the location and limits of removal areas, locations of support structures and other information pertinent to the remedial action are included in Appendix A. Specifications to implement the remedial construction are included in Appendix B.

6.2 SITE-WIDE INSTITUTIONAL CONTROLS AND COMPLIANCE MONITORING

Institutional controls are administrative measures that are intended to limit the potential for exposure to contamination by limiting Site access and activities. Institutional controls are required where contamination at concentrations greater than CULs will remain on site. Institutional controls will be required for this Site in any areas where remediation to CULs is impractical because of the presence of buildings, roads, utilities or other significant facilities. Common institutional controls include deed restrictions (environmental covenants), compliance monitoring, site use and access limitations, and zoning and ordinances regarding property usage.

The details of the institutional controls necessary for the Site are discussed in detail in the Institutional Controls Plan (ICP) that is presented in Appendix G.

Compliance monitoring will involve periodic sampling and analysis to assess groundwater quality at the CPOC, which is downgradient of the remedial excavation areas. Existing monitoring wells that were installed as part of the RI/FS that will be downgradient of the remedial excavation areas will be used for monitoring activities.

Dissolved phase concentrations of COCs will be evaluated relative to historical site data and to site-specific compliance criteria to monitor Site conditions at the CPOC. Groundwater monitoring will be implemented at the CPOC by sampling and analyzing groundwater from monitoring wells MW-2, MW-3, MW-4, MW-5, MW-8, MW-9 and MW-11 (the East "D" Street wells).

Chemical analytical results from the 2006 Supplemental Groundwater Investigation indicate that natural attenuation processes appear to be active at the Site. Monitoring of chemical parameters relative to natural attenuation at the Site will be performed as part of the compliance monitoring program, as required in WAC 173-340-370.

The Compliance Monitoring Plan (CMP) establishes appropriate response actions that would be triggered if specific concentrations of COCs at the CPOC are exceeded. Potential response actions range from increased groundwater monitoring to additional site investigations and evaluation of the need for more active remedial actions. The details of this sampling, analysis and monitoring plan and a contingency action plan for any potential future response actions are discussed in detail in the CMP that is presented in Appendix F.

Compliance monitoring will be performed at the East "D" Street wells on a quarterly basis until completion of the remedial excavation, and then annually thereafter for a period of 5 years, at which time the compliance monitoring program will be reviewed with Ecology to assess future sampling frequency.

6.3 REMEDIAL DESIGN – GENERAL PROCEDURES

6.3.1 Excavation, Backfill and Grading

- All utilities in the excavations will be protected and/or temporarily rerouted during remedial activities.
- All sidewalks, curbs and road surfaces will be reconstructed as appropriate.
- Access to businesses will be maintained during remedial activities.

6.3.2 Impacted Material Handling and Disposal

- Soil stockpiles, if necessary, will be bermed and tarped and managed to prevent contaminated soil from being mobilized off the Site by wind or in precipitation runoff.
- Excavated soil will be sampled for characterization prior to disposal.
- Excavated soils will be transported to an approved facility for disposal.
- Areas of the excavation will be dewatered if the water impedes the remedial activity. This impacted water will be collected, stored in tanks on-site.
- Impacted water will be sampled for characterization prior to disposal.
- Pending analysis, impacted water will be transported to an approved facility for disposal or discharged to the nearby sanitary sewer.

6.4 AREA A – REMEDIAL DESIGN

The removal of accessible BRPH-contaminated soil at Area A, using sloped excavation walls, will reduce the potential risk of future BRPH migration through the subsurface and/or migration through the storm drainage system. The BRPH-contaminated soil is located adjacent to the east side of the ponds, and contaminants could potentially enter the storm drainage system or groundwater. Excavation adjacent to the WSDOT stormwater ponds is expected to be difficult because of the proximity of the BRPH-containing soil to the ponds. The western limit of the BRPH-containing soil has not been established, and it is possible that some BRPH is located beneath the ponds. To remove this material, the ponds will be excavated to the extent necessary to remove BRPH-containing soil, and then reconstructed after excavation has been completed, as is generally shown in Appendix A. All sides of the excavation will be sloped. BRPH-contaminated soil is generally located between 5 and 12 feet bgs. Approximately 12,000 cubic yards of contaminated soil will be excavated in Area A for disposal.

Precautions to avoid releases to the storm drainage system will be necessary when performing remedial actions in this area. These precautions will include on-hand spill control and cleanup materials and placement of oil traps in the downgradient manholes.

This work would be best done during the dry season (July, August and September) so that groundwater levels and the volume of water in the ponds will be relatively low.

6.4.1 Special Considerations

- Access necessary for cleanup will be obtained from landowners WSDOT and the City as provided under the Consent Decree.
- The existing stormwater pond liner will be removed to access the BRPH-contaminated soils. The liner will be reinstalled by others.

- A temporary stormwater bypass will be installed and operated by others until the stormwater ponds are reconstructed. The stormwater ponds will be reconstructed by others.
- The abandoned sanitary sewer pipe will be removed and capped where present.

6.4.2 Residual Contamination – Area A

The western limit of the contaminated soil has not been fully determined, and it is possible that contamination extends beneath the ponds. However, petroleum hydrocarbons (including BRPH and PAHs) were not detected in soil samples obtained from borings RI-45 and RI-46 and monitoring wells MW-2 and MW-3, located within the East “D” Street right-of-way to the west of the ponds. BRPH was detected in one groundwater sample obtained from monitoring well MW-2 in October 2004. No other COCs were detected in groundwater samples obtained during any other monitoring event from monitoring wells MW-2 and MW-3, located west of and downgradient from the ponds. These results indicate that soil contamination likely does not extend into East “D” Street downgradient of Area A.

6.5 AREA B – REMEDIAL DESIGN

Removal of accessible BRPH-contaminated soil at Area B will further reduce the potential for migration of COCs via groundwater or the storm drainage system. This work will be done during the dry season (July, August and September) so that groundwater levels will be relatively low. During the construction design process, it was determined that combining Areas B1 and B2 into a single excavation area with sloped sides would provide a more cost-effective and complete removal of BRPH-contaminated soil in this area. It was also determined that, because of geotechnical considerations, sloped excavations should be employed throughout Area B, rather than use of sheet pile walls as described in the draft final CAP.³

Excavation and removal of all the BRPH-containing soil in Area B is impractical because of existing utilities, the presence of the closed-in-place UST and the presence of the Tacoma Fixtures building, as shown in Figure 4.

The sides of the remedial area will be sloped to allow excavation of BRPH-contaminated soil to the maximum extent practicable. Approximately 4,000 cubic yards of contaminated soil will be excavated for disposal. BRPH-contaminated soil is generally located between 5 and 12 feet bgs.

6.5.1 Special Considerations

- Access necessary for cleanup will be obtained from landowners Nichols Trucking, Home Electric and the City as provided under the Consent Decree.
- A sanitary sewer line and lateral, a gas main, a water main, overhead power lines, a stormwater line and an abandoned water line are all located within the excavation area. These utilities will be protected and/or temporarily rerouted.
- East 19th Street will be closed, and an appropriate detour route will be installed.

³ Geotechnical evaluation indicated that sheet piles would need to be embedded to at least 45 feet below the ground surface, rather than 25 feet as assumed in the CAP due to soft soil conditions. The increased embedment depth made the installation more difficult and substantially increased the installation costs. It was determined that open-excavation would be more feasible to construct and would be more cost effective.

6.5.2 Residual Contamination – Area B

It is possible that contamination may extend under the Tacoma Fixtures building on the north side of the excavation. Any contaminated soil located on the north side the excavation will not be practicable to excavate and will be left in place.

Multiple active utilities cross the remedial area. Contaminated soil located in the proximity of these utilities may be left in place if it is impractical to remove/reroute the utilities to excavate the contaminated soil. To the extent practical, soil with high TOC content will be used as backfill adjacent to areas where BRPH-contaminated soil remains on site.

6.6 AREA C – REMEDIAL DESIGN

Removal of accessible BRPH-contaminated soil at Area C will reduce the potential for migration of COCs via groundwater. Excavation of BRPH-containing soil in Area C is expected to be complicated by proximity of the contaminated soil to the SuperValu and Tacoma Fixtures buildings. Structural shoring will be installed adjacent to the buildings on the east side of the excavation and a portion of the west side of the excavation along East “D” Street, as shown in Figure 4. The remaining sides of the excavation will be sloped. BRPH-contaminated soil is generally located between 6 and 10 feet bgs. Approximately 17,000 cubic yards of contaminated soil will be removed for disposal.

A sanitary sewer line, a gas line lateral, a sewer line lateral and a water line are located within the excavation area and would need to be protected and/or temporarily rerouted during excavation activities. This work should be done during the dry season (July, August and September) when groundwater levels will be relatively low.

6.6.1 Structural Shoring Requirements

- Structural shoring will be installed on the east and west sides of the remedial area as shown in Appendix A.

6.6.2 Special Considerations

- Access necessary for cleanup will be obtained from landowners Home Electric, SuperValu and the City as provided under the Consent Decree.
- The sidewalk on the west side of the remedial area will be closed, and an appropriate detour route will be installed.

6.6.3 Residual Contamination – Area C

Structural shoring will be used along the east and west sides of the remedial area, as shown in Appendix A. It is possible that contamination may extend under the Tacoma Fixtures and/or the SuperValu buildings on the east side of the excavation or beneath East “D” Street on the west side of the excavation. Any contaminated soil located on the east side the structural shoring or beneath East “D” Street will not be practicable to excavate and will be left in place. To the extent practical, soil with high TOC content will be used as backfill adjacent to areas where BRPH-contaminated soil remains on site.

6.7 AREA D – REMEDIAL DESIGN

Excavation and disposal of BRPH-contaminated soil in Area D is intended to reduce potential future risks related to future excavation and/or contact with contaminated soil at this location. The BRPH-

contaminated soil is generally located between 1.5 and 4 feet bgs. The sides of the excavation will be sloped. Approximately 600 cubic yards of contaminated soil will be removed for disposal.

6.7.1 Special Considerations

- Access necessary for cleanup will be obtained from landowners SuperValu and the City as provided under the Consent Decree.
- The sidewalk on the northwest corner of the excavation will be removed as necessary to allow sloped excavation rather than use of sheet pile as described in the draft final CAP.
- The sidewalk on the northwest side of the remedial area will be closed, and an appropriate detour route will be installed.

6.7.2 Residual Contamination – Area D

The results of the RI/FS indicate that all of the contaminated soil at Area D is accessible, and that complete excavation and removal of the contaminated soil can be accomplished.

7.0 SCHEDULE

The proposed general schedule for implementation of the remedial action is as described below. It assumes two phases of construction, the first occurring July through September 2008 and the second June through September 2009. The schedule will be revised as necessary if only one phase of construction (2008) is needed. The 2008 construction schedule will also be revised as necessary if the public comment period or entry of the Consent Decree are substantially delayed.

Item	Activity	Date
1	GeoEngineers – Submit State Environmental Policy Act (SEPA) checklist to Ecology for review	March 28, 2008
2	GeoEngineers – Submit Draft EDR, including, Sampling and Analysis Plan, Health and Safety Plan, Compliance Monitoring Plan and Institutional Control Plan, to Ecology for review	April 30, 2008
3	GeoEngineers – Meet with Ecology to submit Plans and Specifications for Draft EDR	May 2, 2008
4	Ecology – Release Draft Final RI/FS, Draft Final CAP, and Draft EDR (including all appendices) and Draft Consent Decree for public comment	May 7, 2008
5	GeoEngineers – Coordinate with and obtain proposals from potential contractors based on Draft EDR	May 7, 2008 – May 30, 2008
6	Ecology – Provide comments regarding the Draft EDR	May 30, 2008
7	Ecology – Receive public comment regarding Draft Final RI/FS, Draft Final CAP, Draft EDR and Draft Consent Decree	June 7, 2008
8	GeoEngineers – Incorporate Ecology and public comments into Draft EDR and submit Final EDR to Ecology	June 20, 2008
9	GeoEngineers – Provide Final EDR to contractor to establish scope of work and basis for construction contract	June 20, 2008
10	Ecology – Enter Consent Decree, including Final CAP, and approve Final EDR	June 27, 2008

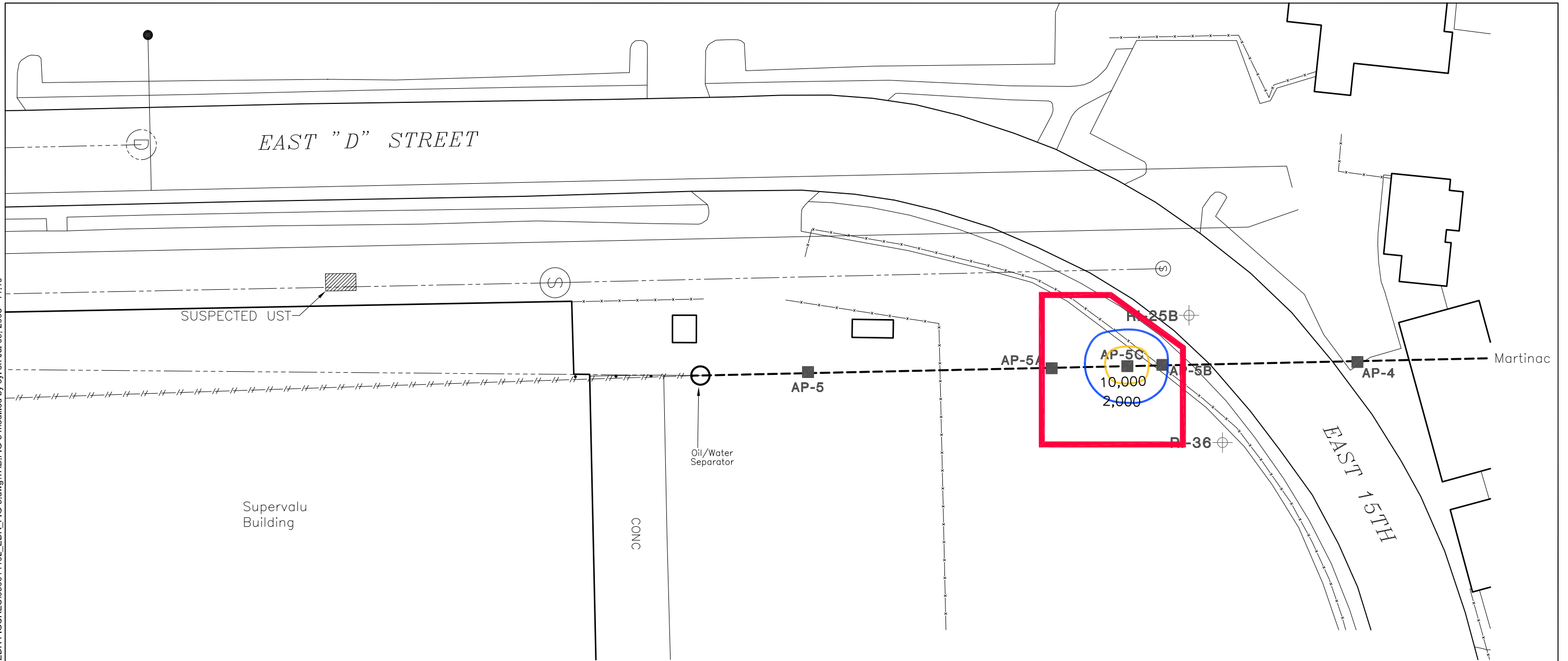
Item	Activity	Date
11	GeoEngineers – Execute contract and issue Notice to Proceed to contractor for work on D Street	June 30, 2008
12	GeoEngineers – Mobilize contractor to Site and begin construction	July 21, 2008
13	GeoEngineers – Complete Phase I remedial construction/demobilize contractor	August 20, 2008
14	GeoEngineers – Mobilize contractor to Site and begin Phase II construction	June 15, 2009
15	GeoEngineers – Complete Phase II remedial construction/demobilize contractor	September 30, 2009
16	GeoEngineers – Begin Annual Monitoring Under Compliance Monitoring Program	January 1, 2010
17	GeoEngineers – Submit Draft Remedial Action Report, including proposed Environmental Covenants	90 days after completing remedial construction
18	Ecology – Provide comments regarding the Draft Remedial Action Report	30 days after receiving Draft Remedial Action Report
21	GeoEngineers – Incorporate Ecology comments and submit Final Remedial Action Report to Ecology	30 days after receiving Ecology comments

8.0 REFERENCES

- GeoEngineers, Inc. (2003), “Summary Report, “D” Street Pipeline Closure,” Tacoma, Washington.
- GeoEngineers, Inc. (2004a), “Groundwater Investigation BNSF Oil Pipeline Site,” Tacoma, Washington.
- GeoEngineers, Inc. (2004b), “Final Interim Action Report, BNSF Oil Pipeline Site,” Tacoma, Washington.
- GeoEngineers, Inc. (2008), “Revised Draft Final Cleanup Action Plan, The BNSF Oil Pipeline Site,” Tacoma, Washington.
- GeoEngineers, Inc. (2007), “Final Remedial Investigation/Feasibility Study, BNSF Oil Pipeline Site,” Tacoma, Washington.
- Langseth Environmental (2002a), “Site Characterization Report, Nichols Trucking DOE Site ID# 011950, Underground Storage Tank Removal Project.”
- Langseth Environmental (2002b), “Final Voluntary Cleanup Report, Nichols Trucking, WDOE Site ID#011950, Petroleum Contaminated Soil Remediation Project.”
- Model Toxics Control Act (MTCA) Cleanup Regulations, Washington Administrative Code, Chapter 173-340. Washington State Department of Ecology.
- Robinson, Noble, Saltbush, Inc. (2005), “Tacoma Fixtures Property, 19th Street Underground Storage Tank Closure Report.”

P:\0050614102\CAD\TSC\IEDR\EDR_FIG-5.dwg/TAB:FIG-5 modified by sy on Jul 09, 2008 - 11:10

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EXPLANATION:

BRPH CONCENTRATIONS

- 2,000 mg/kg
- 10,000 mg/kg
- mg/kg MILLIGRAMS PER KILOGRAM

APPROXIMATE LIMITS OF REMEDIAL AREAS

RI-41 2004 REMEDIAL INVESTIGATION BORING

AP-5C 2002 PIPELINE ACCESS PIT

STORM WATER OUTFALL

SEWER MANHOLE

STORM WATER MANHOLE

PIPELINE GROUTED IN PLACE

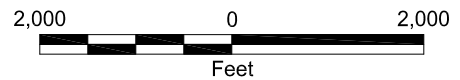
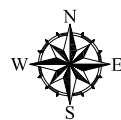
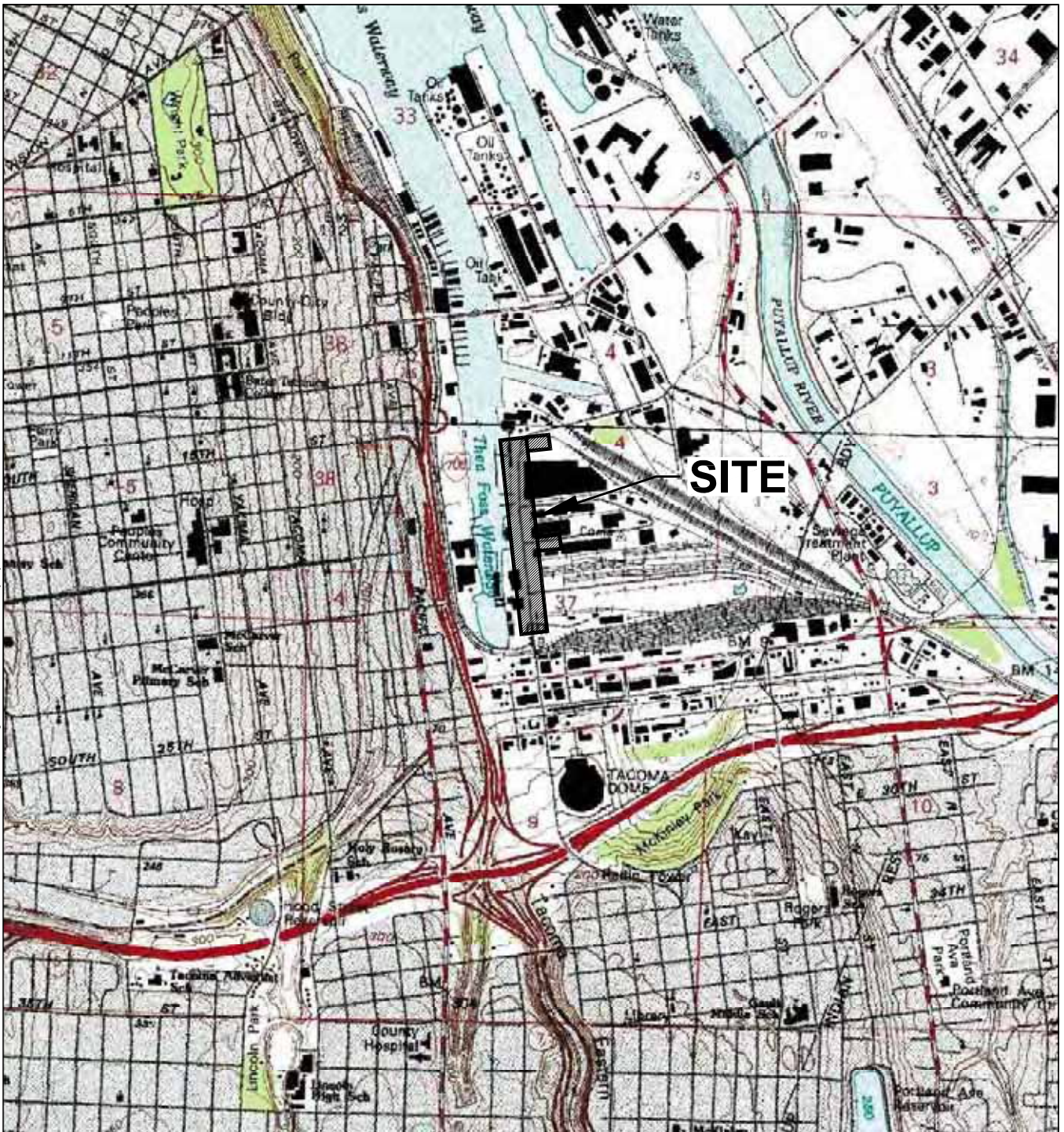
PIPELINE PRESENCE UNKNOWN

Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Reference: Drawing created from AutoCAD file, E.D st-oil line-b.DWG", provided by City of Tacoma.

Remedial Area - Area D Engineering Design Report	
BNSF Oil Pipeline Site (D Street) Tacoma, Washington	
GEOENGINEERS	Figure 5



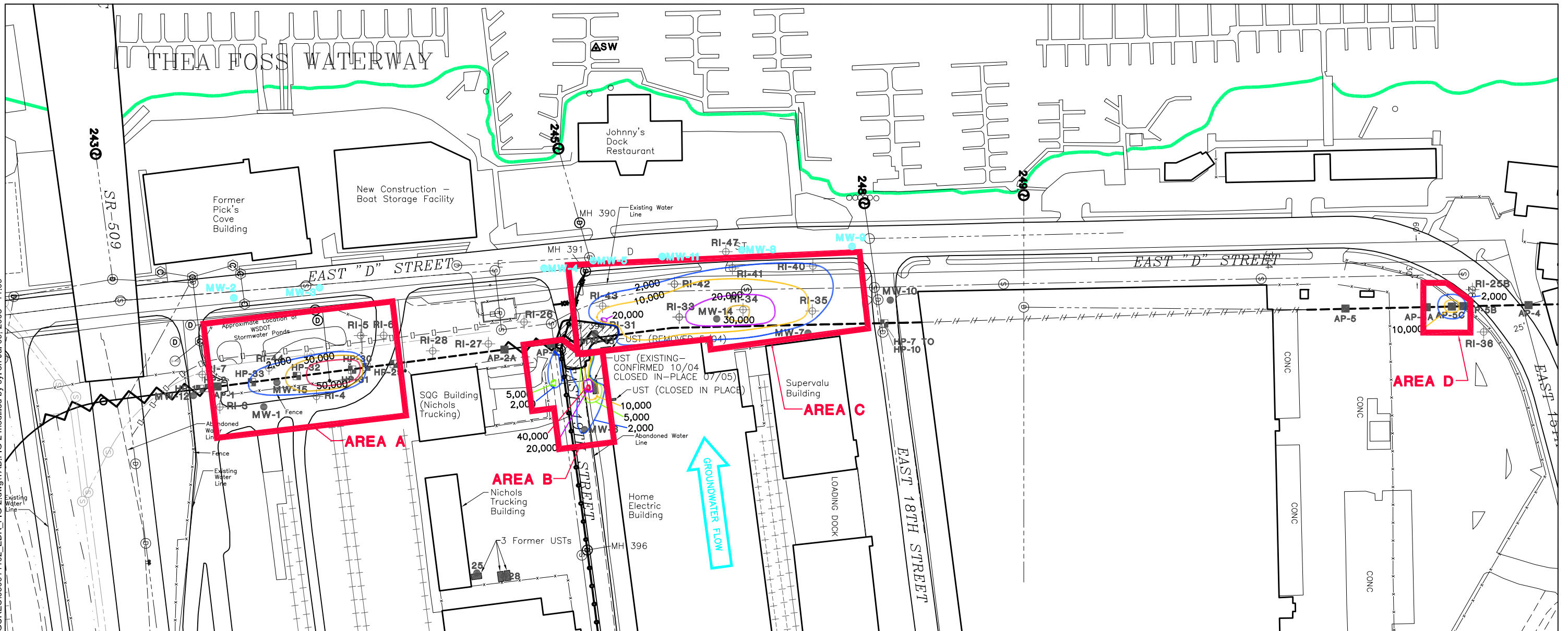
Notes:

1. The locations of all features shown are approximate.
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Reference: Sure Maps! Raster Maps- USGS based quadrangles.

Vicinity Map Engineering Design Report	
BNSF Oil Pipeline Site (D Street) Tacoma, Washington	
GEOENGINEERS	Figure 1

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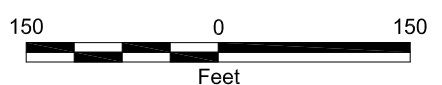
EXPLANATION:

- MW-1** ● MONITORING WELL
- MW-5** ● MONITORING WELL LOCATION AT THE CONDITIONAL POINTS OF COMPLIANCE
- RI-42** ⊕ 2004 REMEDIAL INVESTIGATION BORING
- 25** ● SOIL SAMPLE BY OTHERS
- HP-31** ■ 2002 BORING
- AP-1** ■ 2002 PIPELINE ACCESS PIT

- SWA** △ STILLING WELL LOCATION
- ⊙ STORM WATER OUTFALL
- ⊙ SEWER MANHOLE
- ⊙ CATCH BASIN
- ⊙ STORM WATER MANHOLE
- HISTORIC PIPELINE ALIGNMENT
- - - PIPELINE REMOVED
- - - PIPELINE GROUTED IN PLACE
- - - SLIP-LINED STORM DRAIN
- - - STORM DRAIN HAS BEEN REPLACED
- - - ABANDONED 15-INCH PLASTIC SANITARY SEWER PIPE

- THEA FOSS SHORELINE
- ▨ LIMITS OF INTERIM REMEDIAL EXCAVATION
- ▭ APPROXIMATE LIMITS OF REMEDIAL AREAS

- BRPH CONCENTRATIONS**
- 2,000 mg/kg
 - 5,000 mg/kg
 - 10,000 mg/kg
 - 20,000 mg/kg
 - 30,000 mg/kg
 - 40,000 mg/kg
 - 50,000 mg/kg
- mg/kg MILLIGRAMS PER KILOGRAM



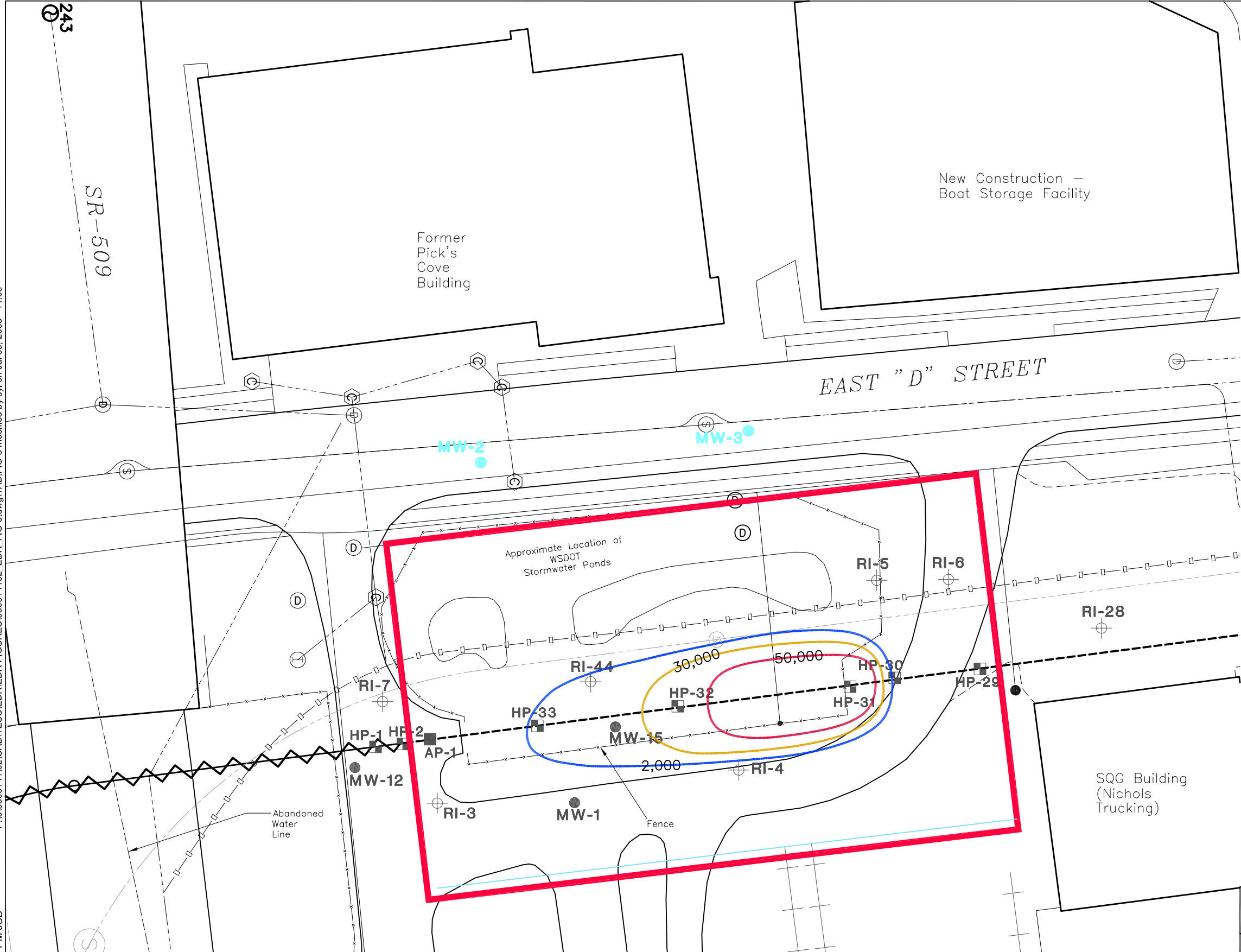
Notes:
 1. The locations of all features shown are approximate.
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Reference: Drawing created from AutoCAD file, E.D st-oil line-b.DWG", provided by City of Tacoma.

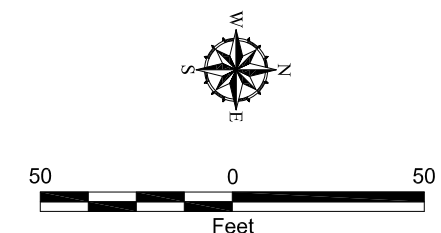
Remedial Areas Engineering Design Report	
BNSF Oil Pipeline Site (D Street) Tacoma, Washington	
GEOENGINEERS	Figure 2

P:\10050614\102\CAD\TSC\EDR\FIGURES\050614102_EDR_FIG-3.dwg/TAB:FIG-3 modified by syt on Jul 09, 2008 - 11:09

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- EXPLANATION:**
- MW-1** ● MONITORING WELL
 - MW-5** ● MONITORING WELL LOCATION AT THE CONDITIONAL POINTS OF COMPLIANCE
 - RI-42** ⊕ 2004 REMEDIAL INVESTIGATION BORING
 - 25** ● SOIL SAMPLE BY OTHERS
 - HP-31** ■ 2002 BORING
 - AP-1** ■ 2002 PIPELINE ACCESS PIT
 - SWA** ▲ STILLING WELL LOCATION
 - ⊙ STORM WATER OUTFALL
 - Ⓢ SEWER MANHOLE
 - ⓐ CATCH BASIN
 - ⓓ STORM WATER MANHOLE
 - HISTORIC PIPELINE ALIGNMENT
 - PIPELINE REMOVED
 - - - PIPELINE GROUTED IN PLACE
 - - - ABANDONED 15-INCH PLASTIC SANITARY SEWER PIPE
- BRPH CONCENTRATIONS**
- 2,000 mg/kg
 - 30,000 mg/kg
 - 50,000 mg/kg
 - mg/kg MILLIGRAMS PER KILOGRAM
- APPROXIMATE LIMITS OF REMEDIAL AREAS



Notes:

- The locations of all features shown are approximate.
- This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Reference: Drawing created from AutoCAD file, "E.D st-oil line-b.DWG", provided by City of Tacoma.

**Remedial Area - Area A
Engineering Design Report**

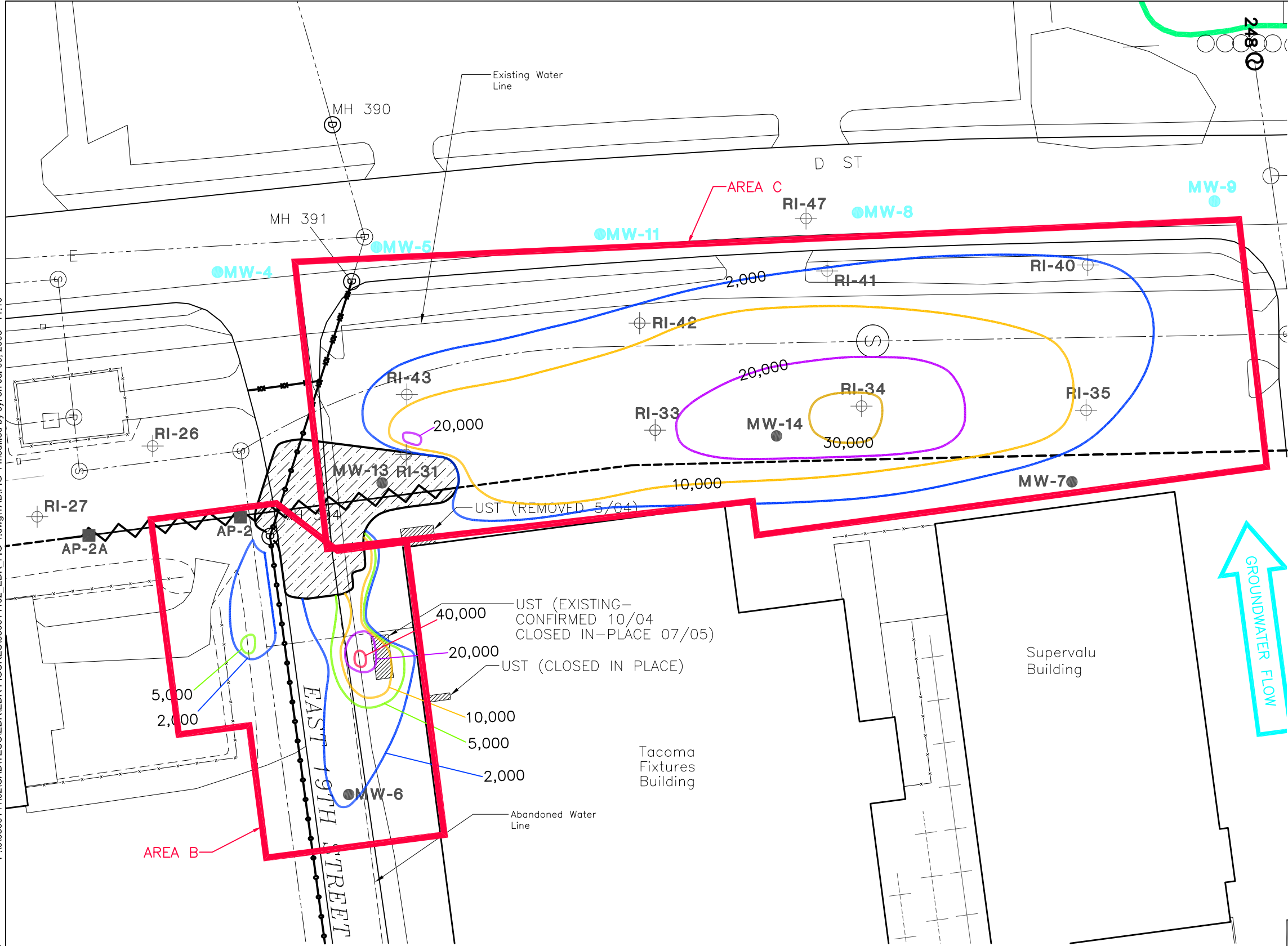
BNSF Oil Pipeline Site (D Street)
Tacoma, Washington

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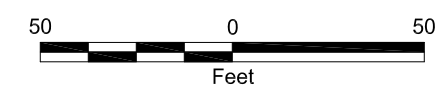
Figure 3

P:\0050614\102\CAD\TSC\EDR\FIGURES\050614102_EDR_FIG-4.dwg/TAB:FIG-4 modified by syron Jul 09, 2008 - 11:10

OFFICE:TACO PM JCD



- EXPLANATION:**
- MW-1** ● MONITORING WELL
 - MW-5** ● MONITORING WELL LOCATION AT THE CONDITIONAL POINTS OF COMPLIANCE
 - RI-42** ⊕ 2004 REMEDIAL INVESTIGATION BORING
 - 25** ● SOIL SAMPLE BY OTHERS
 - HP-31** ■ 2002 BORING
 - AP-1** ■ 2002 PIPELINE ACCESS PIT
 - SWA** ▲ STILLING WELL LOCATION
 - ⊙ STORM WATER OUTFALL
 - ⊙ SEWER MANHOLE
 - ⊙ CATCH BASIN
 - ⊙ STORM WATER MANHOLE
 - HISTORIC PIPELINE ALIGNMENT
 - PIPELINE REMOVED
 - PIPELINE GROUTED IN PLACE
 - SLIP-LINED STORM DRAIN
 - STORM DRAIN HAS BEEN REPLACED
 - ABANDONED 15-INCH PLASTIC SANITARY SEWER PIPE
 - THEA FOSS SHORELINE
 - ▨ LIMITS OF INTERIM REMEDIAL EXCAVATION
- BRPH CONCENTRATIONS**
- 2,000 mg/kg
 - 5,000 mg/kg
 - 10,000 mg/kg
 - 20,000 mg/kg
 - 30,000 mg/kg
 - 40,000 mg/kg
- mg/kg MILLIGRAMS PER KILOGRAM
- ▭ APPROXIMATE LIMITS OF REMEDIAL AREAS



**Remedial Areas - Areas B and C
Engineering Design Report**

BNSF Oil Pipeline Site (D Street)
Tacoma, Washington

Figure 4

Notes:

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APPENDIX A
PLAN SHEETS



THE BNSF RAILWAY COMPANY OIL PIPELINE SITE TACOMA, WASHINGTON

INDEX OF DRAWINGS

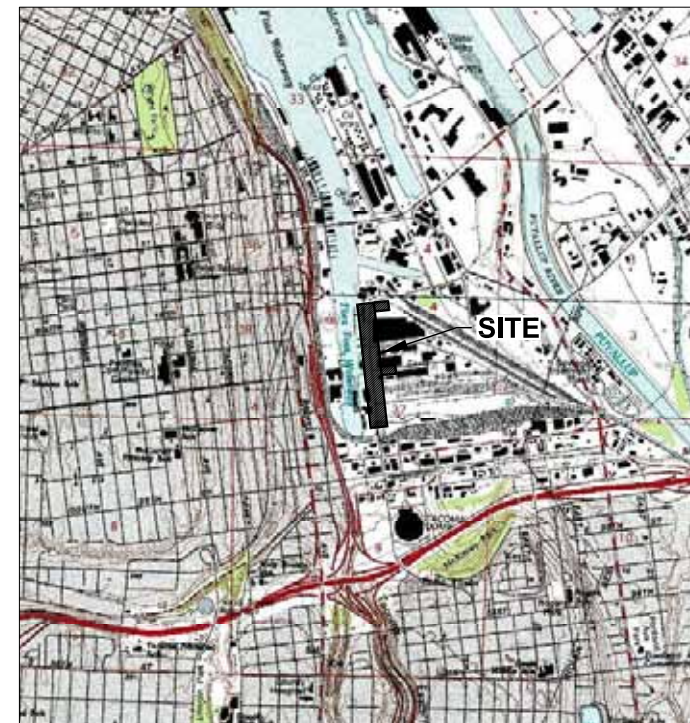
SHEET NUMBER

DESCRIPTION

G-1	COVER SHEET
C-1	SITE PLAN - REMEDIAL AREAS
C-2	REMEDIAL AREA A EXISTING CONDITIONS
C-3	REMEDIAL AREA B EXISTING CONDITIONS
C-4	REMEDIAL AREA C EXISTING CONDITIONS
C-5	REMEDIAL AREA D EXISTING CONDITIONS
C-6	AREA A EXCAVATION PLAN
C-7	REMEDIAL AREA A POND SUBGRADE ELEVATIONS / FINAL SITE GRADE FOR REMEDIAL CONSTRUCTION
C-8	AREA B EXCAVATION PLAN
C-9	AREA C EXCAVATION PLAN
C-10	AREA D EXCAVATION PLAN
C-11	REMEDIAL AREA A SITE CONTROL
C-12	REMEDIAL AREA B SITE CONTROL
C-13	REMEDIAL AREA C SITE CONTROL
C-14	REMEDIAL AREA D SITE CONTROL
C-15	REMEDIAL AREA A CROSS SECTION A-A' (PRE EXCAVATION)
C-16	REMEDIAL AREA B CROSS SECTION B-B' (PRE EXCAVATION)
C-17	REMEDIAL AREA C CROSS SECTION C-C' (PRE EXCAVATION)
C-18	REMEDIAL AREA C AND D CROSS SECTIONS CC-CC' AND D-D' (PRE EXCAVATION)
C-19	REMEDIAL AREA A CROSS SECTION A-A' (POST EXCAVATION)
C-20	REMEDIAL AREA B CROSS SECTION B-B' (POST EXCAVATION)
C-21	REMEDIAL AREA C CROSS SECTION C-C' (POST EXCAVATION)
C-22	REMEDIAL AREA C AND D CROSS SECTIONS CC-CC' AND D-D' (POST EXCAVATION)
D-1	CONSTRUCTION DETAILS
A-1	WSDOT DRAWINGS SHEETS 1 TO 9 (APPENDIX)



LOCATION MAP



Data Source: USGS topo map provided by TerraServer (DRG-Scale4m).

All locations are approximate.

Lambert Conformal Conic
Washington State Plane South
North American Datum 1983

Note: This drawing is for information purpose. It is intended to assist in showing features discussed in an attached document.

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REGISTERED PROFESSIONAL ENGINEER
27707
09/08

BNSF Railway Company, Oil Pipeline Site
Tacoma, Washington

Cover Sheet

Project No.
0506-141-02

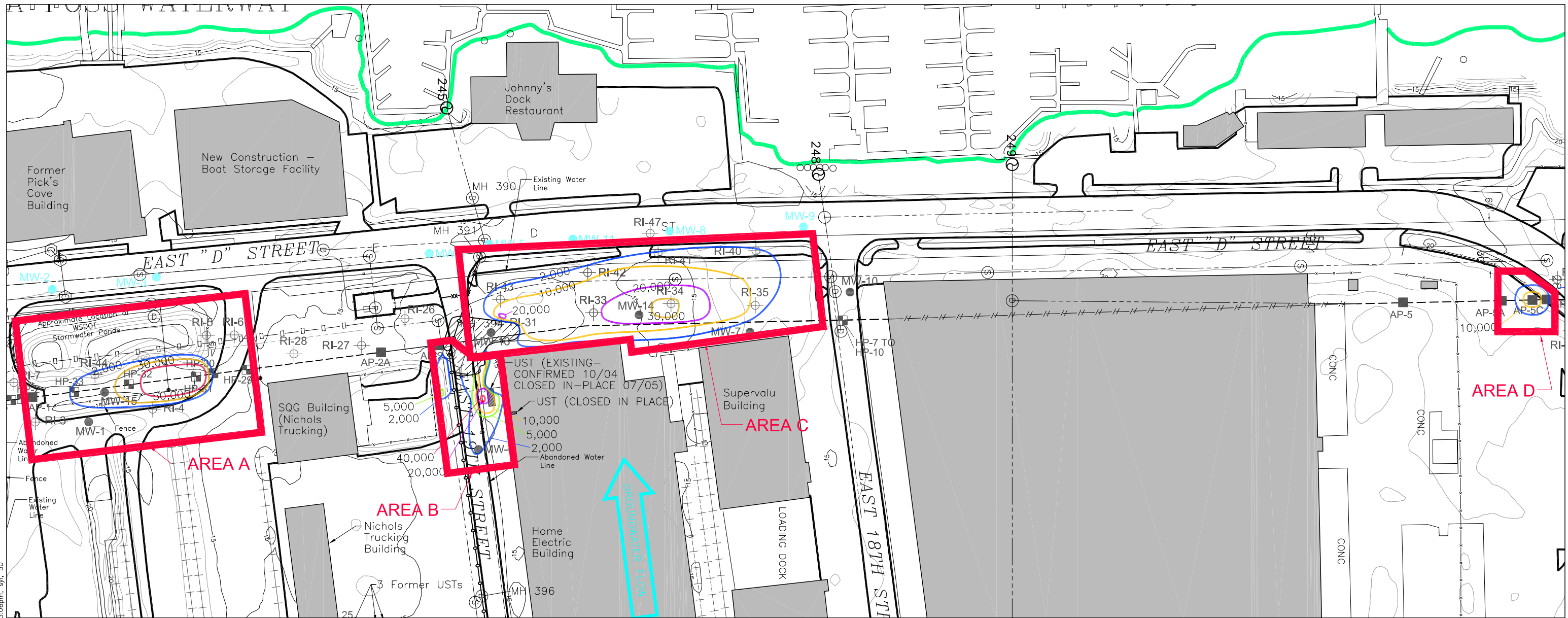
Drawing No.

G-1

Sheet
1 of 24

Reference: Drawing sketch by GeoEngineers.

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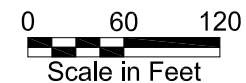
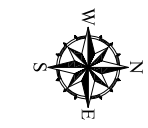
EXPLANATION:

- MW-1 ● MONITORING WELL
- MW-5 ● MONITORING WELL LOCATION AT THE CONDITIONAL POINTS OF COMPLIANCE
- RI-42 ⊕ 2004 REMEDIAL INVESTIGATION BORING
- 25 ● SOIL SAMPLE BY OTHERS
- HP-31 ■ 2002 BORING
- AP-1 ■ 2002 PIPELINE ACCESS PIT

- ⊙ STORMWATER OUTFALL
- ⊙ SEWER MANHOLE
- ⊙ CATCH BASIN
- ⊙ STORMWATER MANHOLE
- HISTORIC PIPELINE ALIGNMENT
- PIPELINE REMOVED
- - - PIPELINE GROUTED IN PLACE
- x - x - x SLIP-LINED STORM DRAIN
- o - o - o STORM DRAIN HAS BEEN REPLACED
- □ - □ - □ ABANDONED 15-INCH SANITARY SEWER PIPE

- THEA FOSS SHORELINE
- ▨ LIMITS OF INTERIM REMEDIAL EXCAVATION
- ▭ APPROXIMATE LIMITS OF REMEDIAL AREAS

- BRPH CONCENTRATIONS**
- 2,000 mg/kg
 - 5,000 mg/kg
 - 10,000 mg/kg
 - 20,000 mg/kg
 - 30,000 mg/kg
 - 40,000 mg/kg
 - 50,000 mg/kg
- mg/kg MILLIGRAMS PER KILOGRAM
BRPH BANKER RANGE PETROLEUM HYDROCARBONS



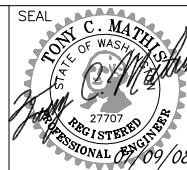
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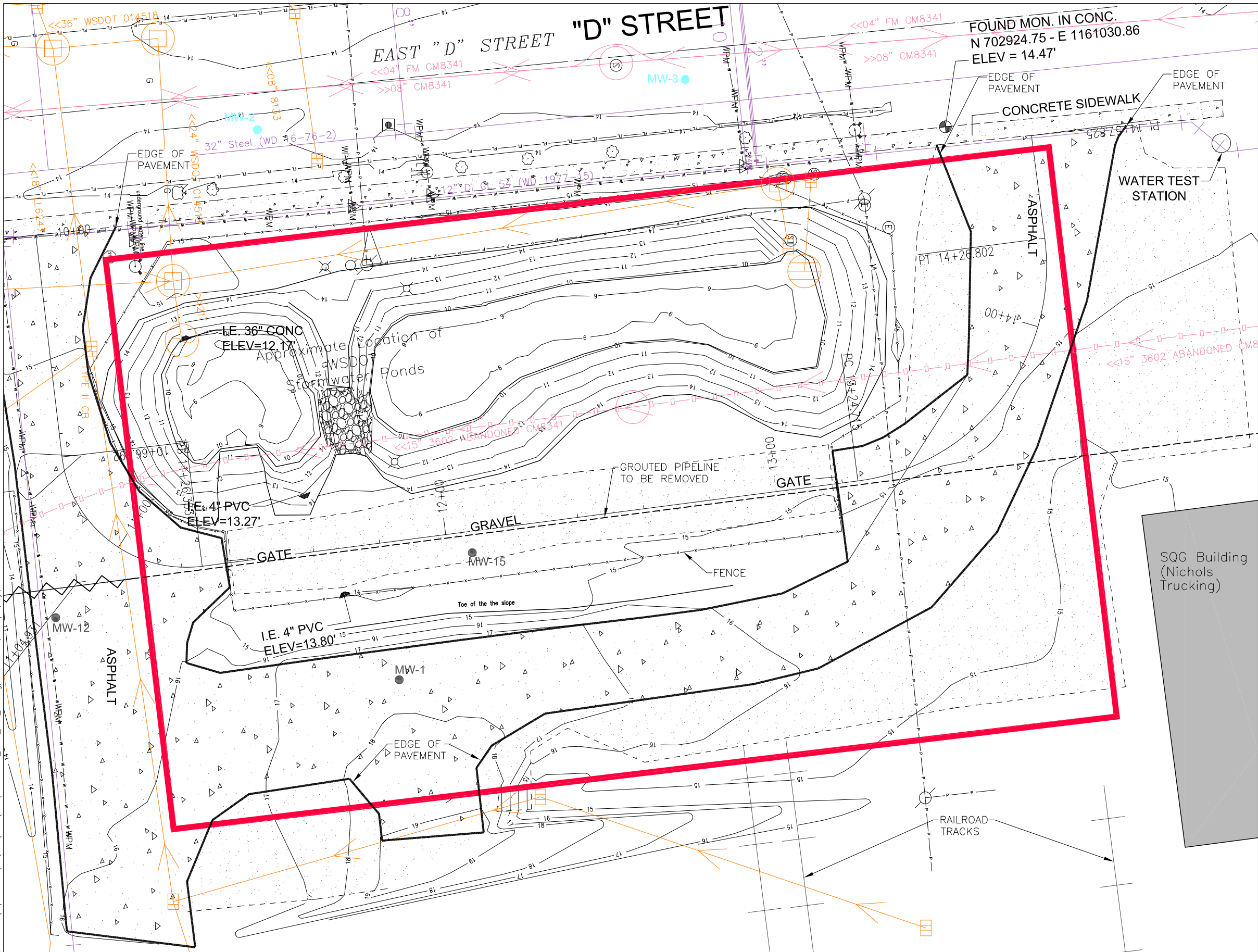
Site Plan - Remedial Areas

Project No. 0506-141-02

Drawing No.

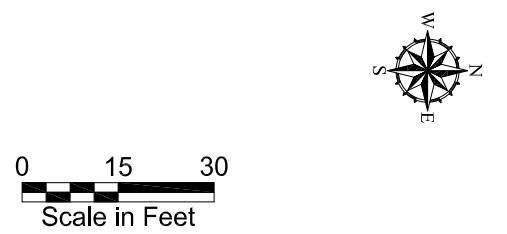
C-1

Sheet 2 of 24



- EXPLANATION:**
- MW-1 ● MONITORING WELL
 - MW-5 ● MONITORING WELL LOCATION AT THE CONDITIONAL POINTS OF COMPLIANCE
 - PIPELINE REMOVED
 - - - PIPELINE GROUTED IN PLACE
 - - - - - ABANDONED 15-INCH SANITARY SEWER PIPE
 - STORM DRAIN
 - SANITARY SEWER PIPE
 - APPROXIMATE LIMITS OF REMEDIAL AREAS

- ⊕ IRRIGATION VALVE
- ⊕ STOP SIGN
- ⊕ CATCH BASIN
- ⊕ FIRE HYDRANT
- ⊕ WATER METER
- ⊕ STORM DRAIN MANHOLE
- ⊕ GAS VALVE
- ⊕ SIGN
- ⊕ TREE
- ⊕ POWER POLE
- ⊕ WATER VALVE
- ⊕ GUY ANCHOR
- ⊕ PHONE RISER
- ⊕ WATER MANHOLE
- ⊕ ORANGE PAINTMARK
- ⊕ GREEN PAINTMARK
- ⊕ SANITARY SEWER MANHOLE
- ⊕ MONUMENT AS NOTED
- EDGE OF PAVEMENT
- DOUBLE YELLOW
- CONCRETE
- - - CHAINLINK FENCE
- - - EDGE OF GRAVEL
- - - OVERHEAD UTILITY
- - - FLOW LINE
- - - WATERLINE
- ⊕ RIPRAP



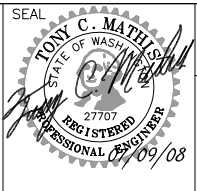
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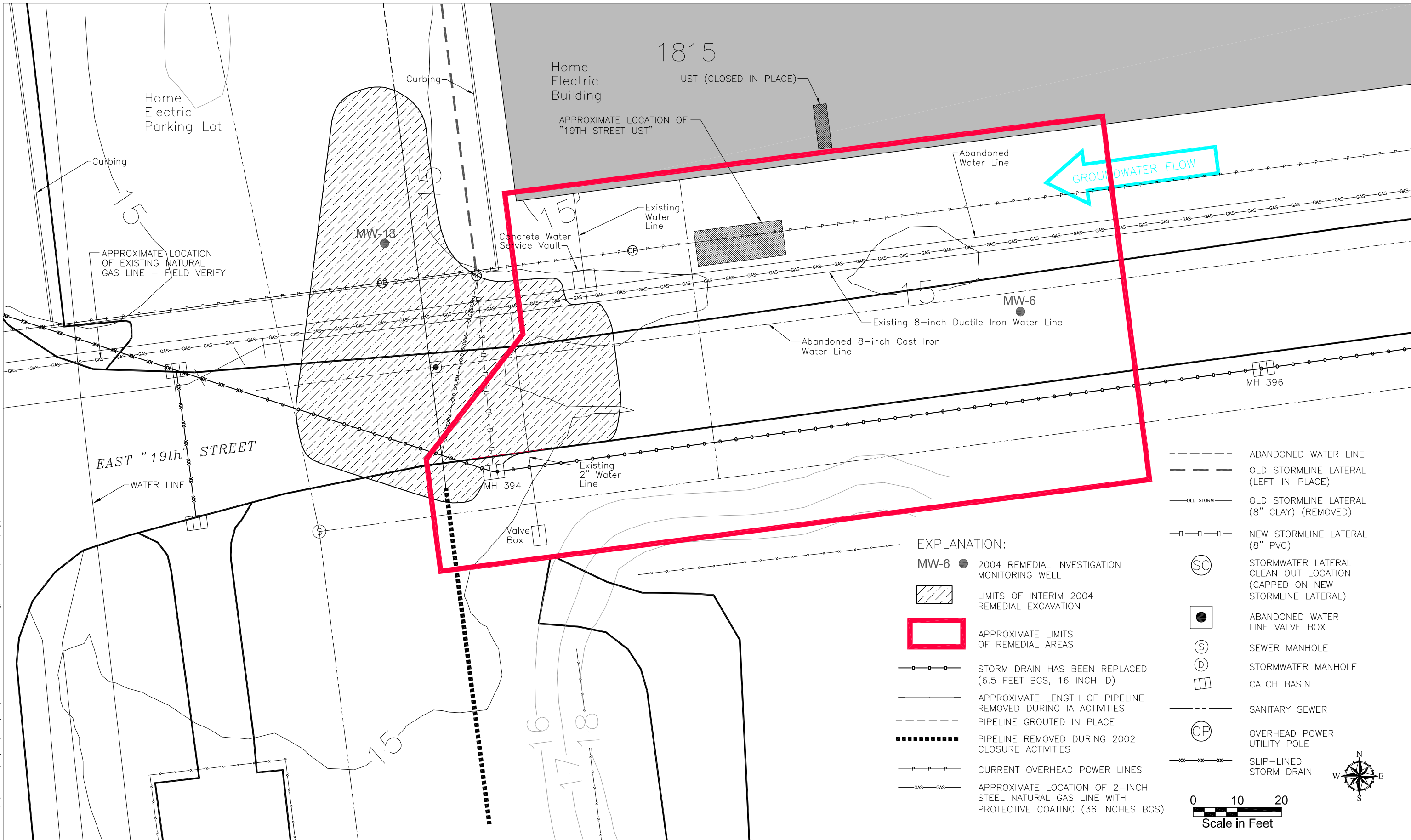
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BNSF Railway Company, Oil Pipeline Site
 Tacoma, Washington

Remedial Area A Existing Conditions

Project No. 0506-141-02
 Drawing No. C-2
 Sheet 3 of 24



- EXPLANATION:**
- ABANDONED WATER LINE
 - - - OLD STORMLINE LATERAL (LEFT-IN-PLACE)
 - OLD STORM — OLD STORMLINE LATERAL (8" CLAY) (REMOVED)
 - NEW STORMLINE LATERAL (8" PVC)
 - SC STORMWATER LATERAL CLEAN OUT LOCATION (CAPPED ON NEW STORMLINE LATERAL)
 - ABANDONED WATER LINE VALVE BOX
 - S SEWER MANHOLE
 - D STORMWATER MANHOLE
 - CATCH BASIN
 - SANITARY SEWER
 - OP OVERHEAD POWER UTILITY POLE
 - xx-xx-xx SLIP-LINED STORM DRAIN
- 0 10 20
Scale in Feet

- MW-6 ● 2004 REMEDIAL INVESTIGATION MONITORING WELL
- LIMITS OF INTERIM 2004 REMEDIAL EXCAVATION
- APPROXIMATE LIMITS OF REMEDIAL AREAS
- STORM DRAIN HAS BEEN REPLACED (6.5 FEET BGS, 16 INCH ID)
- APPROXIMATE LENGTH OF PIPELINE REMOVED DURING IA ACTIVITIES
- - - PIPELINE GROUTED IN PLACE
- PIPELINE REMOVED DURING 2002 CLOSURE ACTIVITIES
- P - P - P - CURRENT OVERHEAD POWER LINES
- GAS - GAS - APPROXIMATE LOCATION OF 2-INCH STEEL NATURAL GAS LINE WITH PROTECTIVE COATING (36 INCHES BGS)

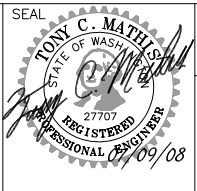
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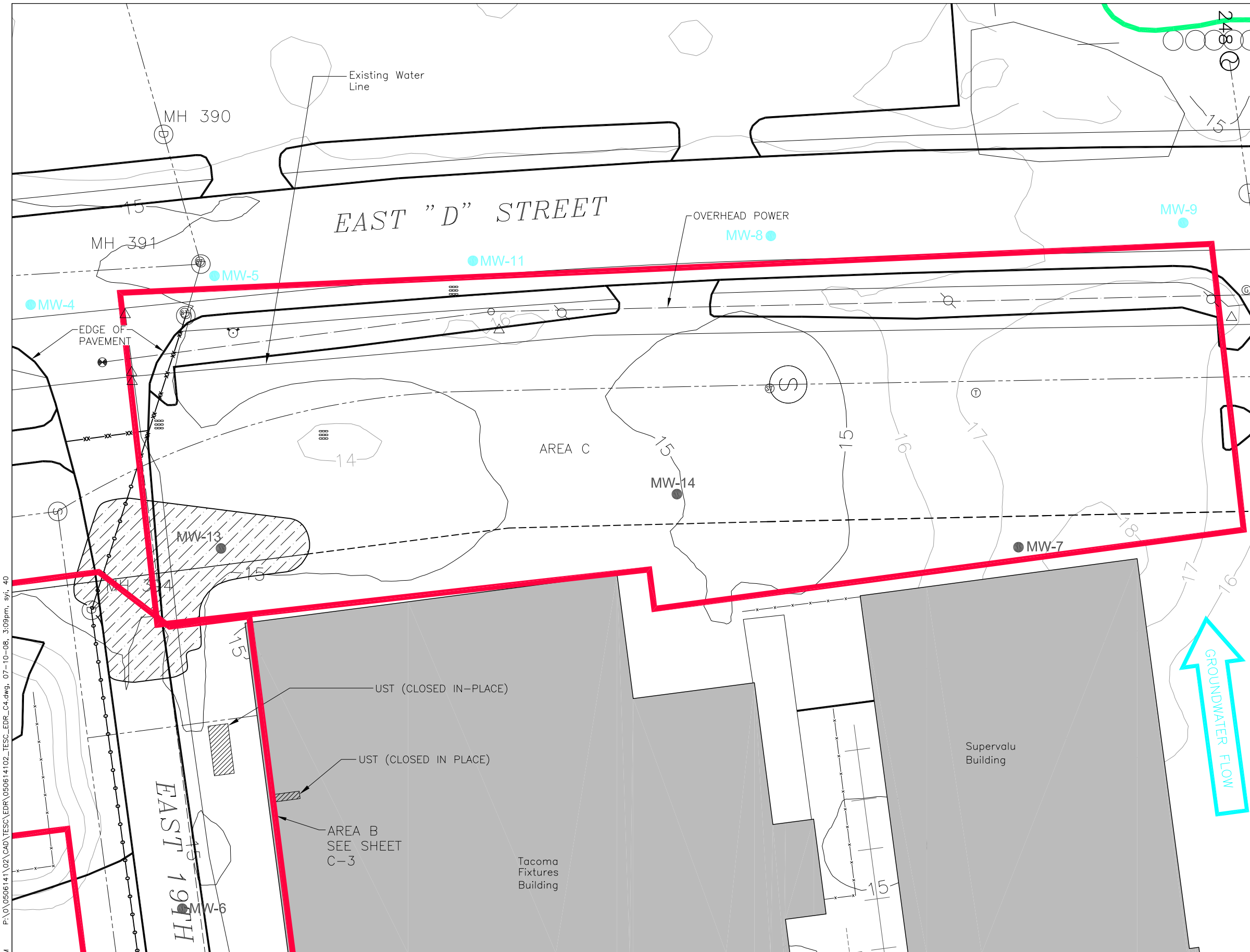
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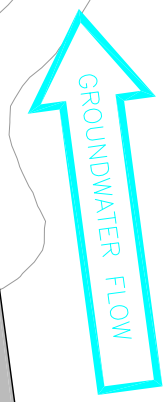
**BNSF Railway Company, Oil Pipeline Site
 Tacoma, Washington**

Remedial Area B Existing Conditions

Project No. 0506-141-02
 Drawing No. C-3
 Sheet 4 of 24



- EXPLANATION:**
- MW-1 ● MONITORING WELL
 - MW-5 ● MONITORING WELL LOCATION AT THE CONDITIONAL POINTS OF COMPLIANCE
 - ⊙ STORMWATER OUTFALL
 - ⊙ SEWER MANHOLE
 - ⊙ CATCH BASIN
 - ⊙ STORMWATER MANHOLE
 - HISTORIC PIPELINE ALIGNMENT
 - PIPELINE REMOVED
 - - - PIPELINE GROUTED IN PLACE
 - x-x-x-x SLIP-LINED STORM DRAIN
 - o-o-o-o STORM DRAIN HAS BEEN REPLACED
 - ABANDONED 15-INCH SANITARY SEWER PIPE
 - ▨ LIMITS OF INTERIM 2004 REMEDIAL EXCAVATION
 - THEA FOSS SHORELINE
 - ▭ APPROXIMATE LIMITS OF REMEDIAL AREAS
- LEROY SURVEY UTILITY**
- ⊙ CATCH BASIN
 - ⊙ FIRE HYDRANT
 - ⊙ STORM DRAIN MANHOLE
 - ⊙ GAS VALVE
 - ⊙ POWER POLE
 - ⊙ WATER VALVE
 - ⊙ SANITARY SEWER CLEANOUT



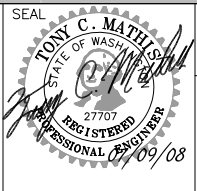
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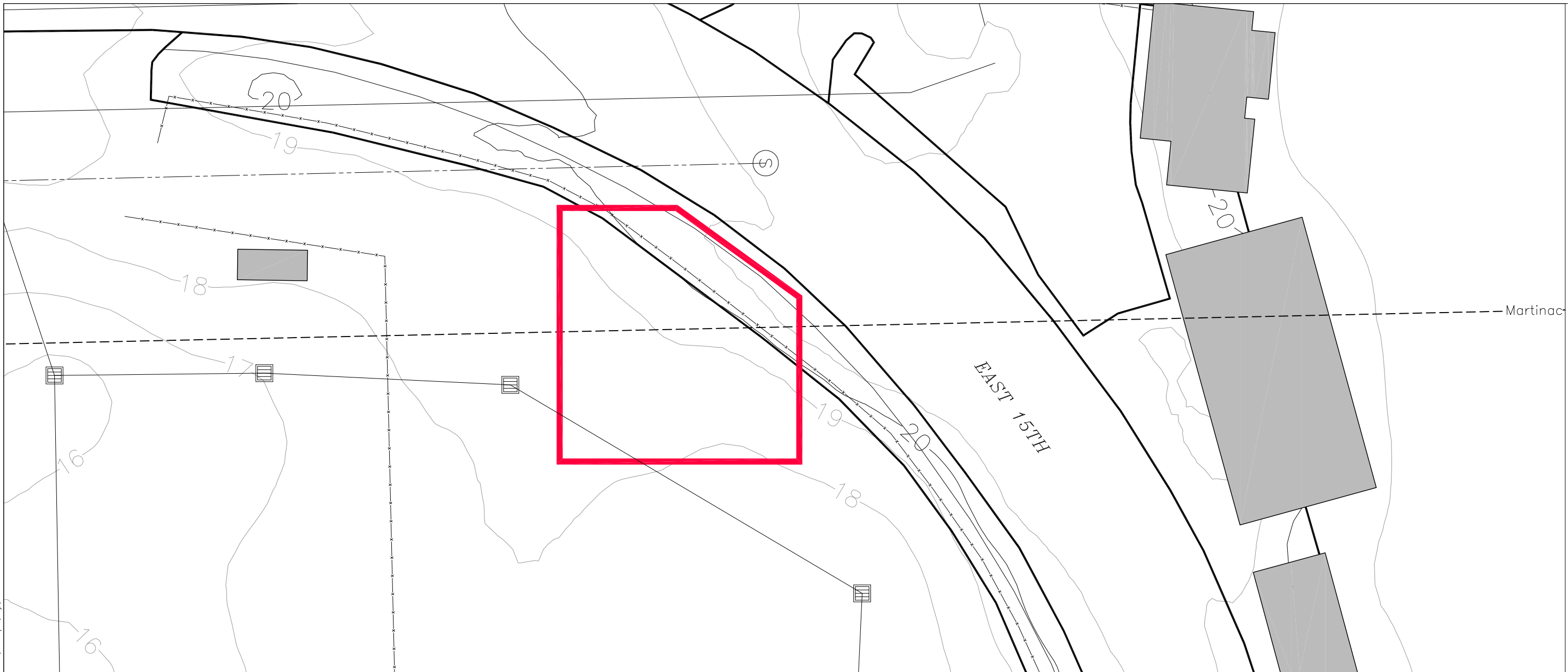
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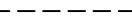
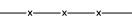

BNSF Railway Company, Oil Pipeline Site
 Tacoma, Washington

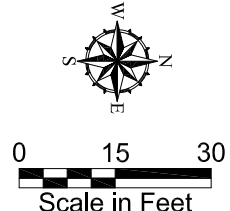
Remedial Area C Existing Conditions

Project No. 0506-141-02
 Drawing No. C-4
 Sheet 5 of 24



EXPLANATION:


-  SEWER MANHOLE
-  PIPELINE GROUTED IN PLACE
-  EXISTING CHAINLINK FENCE
-  APPROXIMATE LIMITS OF REMEDIAL AREAS



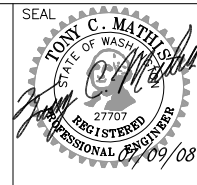
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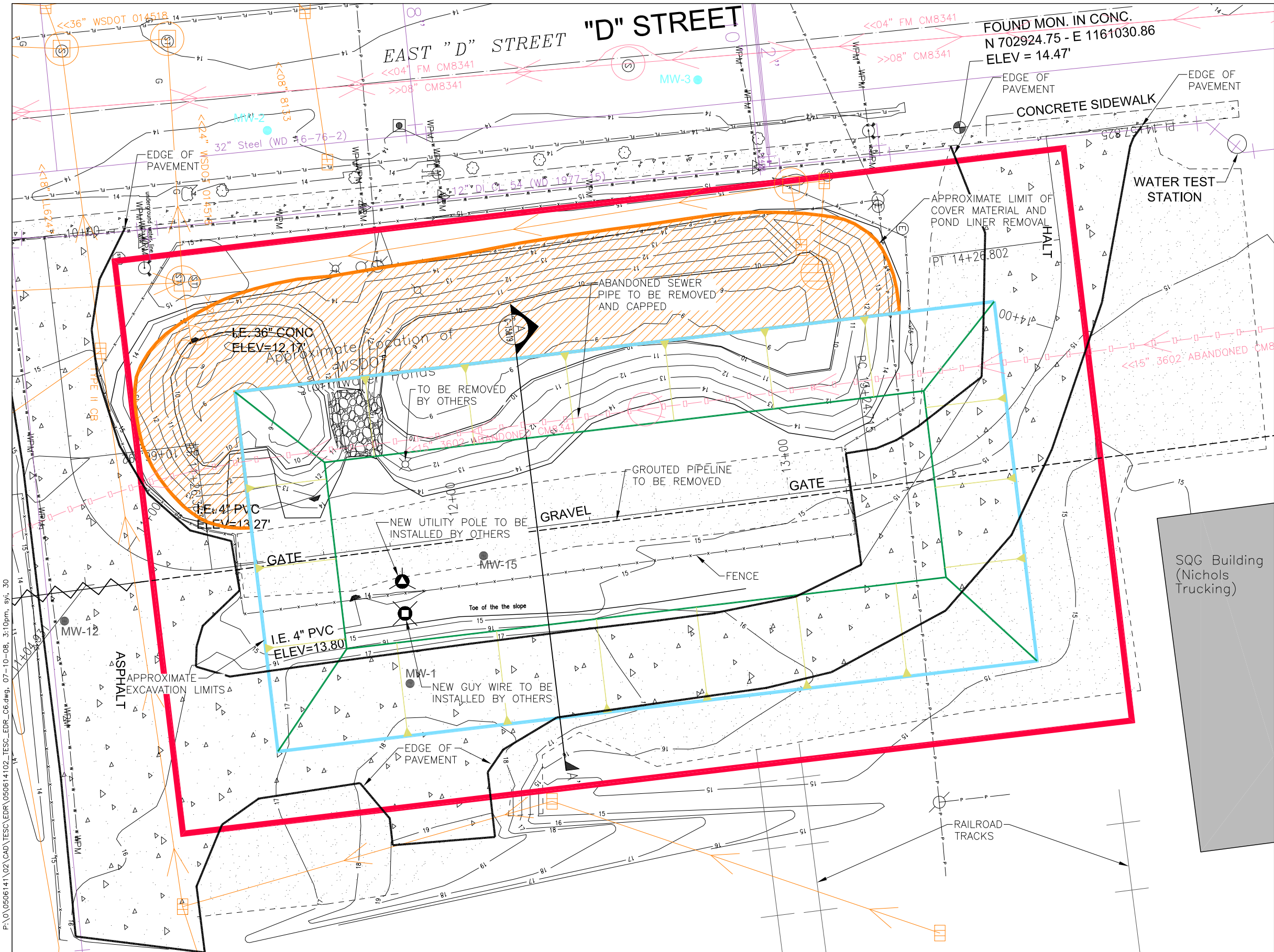


BNSF Railway Company, Oil Pipeline Site
 Tacoma, Washington

Remedial Area D Existing Conditions

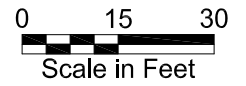
Project No. 0506-141-02
 Drawing No. C-5
 Sheet 6 of 24

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- EXPLANATION:**
- MW-1 ● MONITORING WELL
 - MW-5 ● MONITORING WELL LOCATION AT THE CONDITIONAL POINTS OF COMPLIANCE
 - PIPELINE REMOVED
 - - - PIPELINE GROUTED IN PLACE
 - - - - - ABANDONED 15-INCH SANITARY SEWER PIPE
 - STORM DRAIN
 - SANITARY SEWER PIPE
 - APPROXIMATE LIMITS OF REMEDIAL AREAS
 - APPROXIMATE LIMIT OF CLEANUP ACTION
 - TOP OF EXCAVATION SLOPE
 - EXCAVATION SLOPE 2:1
 - TOE OF EXCAVATION SLOPE
 - A'— APPROXIMATE CROSS SECTION LOCATION

- ⊥ IRRIGATION VALVE
- ⊠ STOP SIGN
- ⊡ CATCH BASIN
- ⊙ FIRE HYDRANT
- ⊙ WATER METER
- ⊙ STORM DRAIN MANHOLE
- ⊙ GAS VALVE
- ⊙ SIGN
- ⊙ TREE
- ⊙ POWER POLE
- ⊙ WATER VALVE
- ⊙ GUY ANCHOR
- ⊙ PHONE RISER
- ⊙ WATER MANHOLE
- ⊙ ORANGE PAINTMARK
- ⊙ GREEN PAINTMARK
- ⊙ SANITARY SEWER MANHOLE
- ⊙ MONUMENT AS NOTED
- EDGE OF PAVEMENT
- DOUBLE YELLOW
- CONCRETE
- CHAINLINK FENCE
- EDGE OF GRAVEL
- OVERHEAD UTILITY
- FLOW LINE
- WATERLINE
- RIPRAP



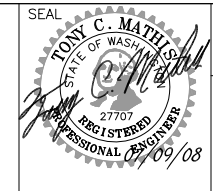
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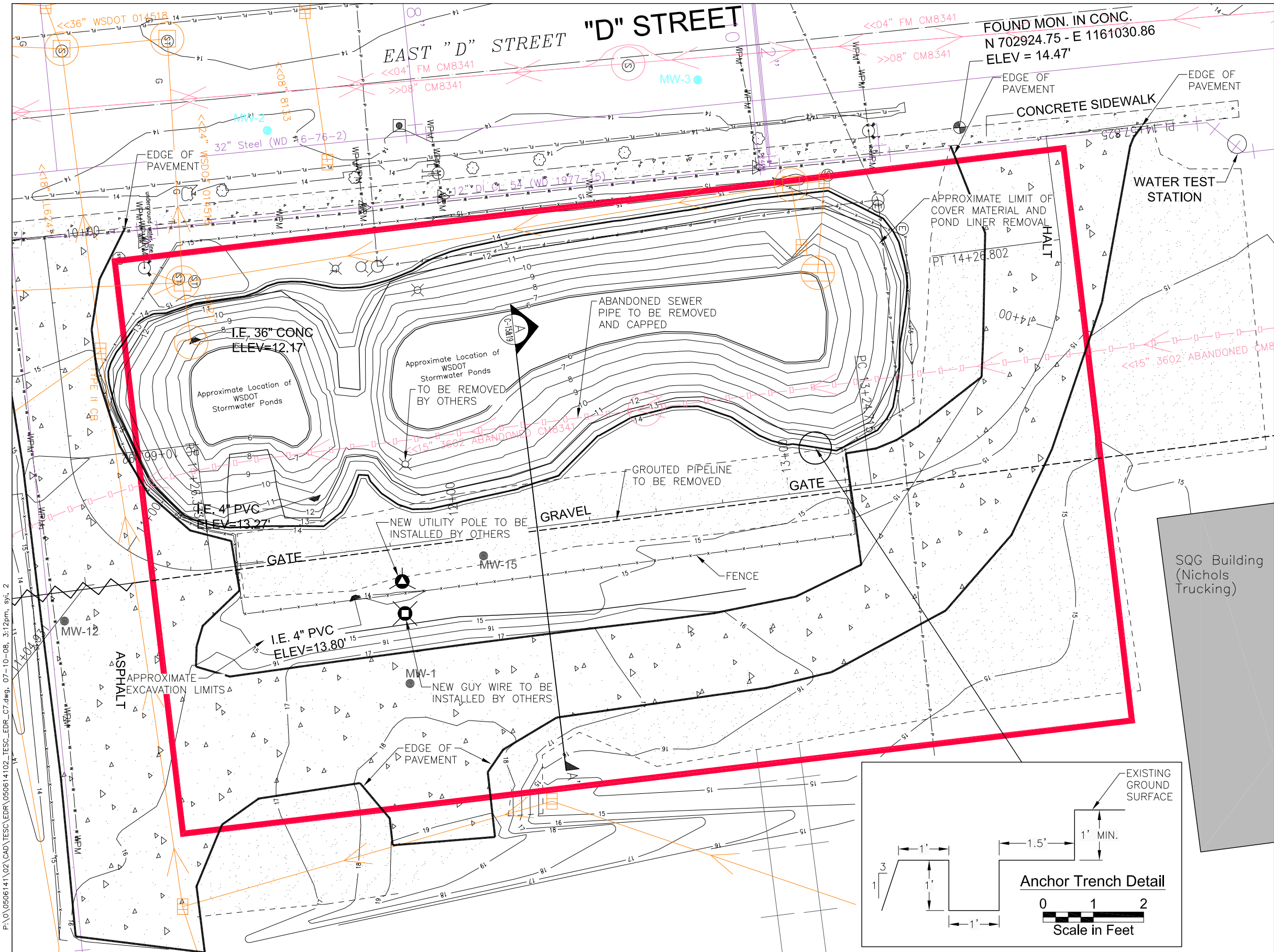
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 Tacoma, Washington

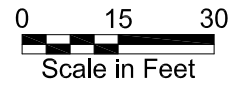
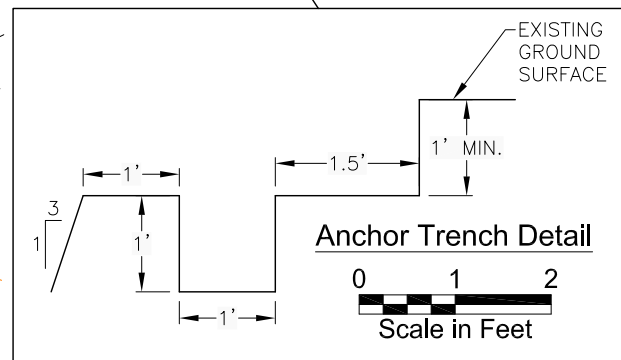
Area A Excavation Plan

Project No. 0506-141-02
 Drawing No. C-6
 Sheet 7 of 24



- EXPLANATION:**
- MW-1 ● MONITORING WELL
 - MW-5 ● MONITORING WELL LOCATION AT THE CONDITIONAL POINTS OF COMPLIANCE
 - PIPELINE REMOVED
 - - - PIPELINE GROUTED IN PLACE
 - - - - - ABANDONED 15-INCH SANITARY SEWER PIPE
 - STORM DRAIN
 - - - - - SANITARY SEWER PIPE
 - APPROXIMATE LIMITS OF REMEDIAL AREAS
 - A'—A' APPROXIMATE CROSS SECTION LOCATION
 - ⊥ IRRIGATION VALVE
 - ⊠ STOP SIGN
 - ⊞ CATCH BASIN
 - ⊙ FIRE HYDRANT
 - ⊙ WATER METER
 - ⊙ STORM DRAIN MANHOLE
 - ⊙ GAS VALVE
 - ⊙ SIGN
 - ⊙ TREE
 - ⊙ POWER POLE
 - ⊙ WATER VALVE
 - ⊙ GUY ANCHOR
 - ⊙ PHONE RISER
 - ⊙ WATER MANHOLE
 - T ORANGE PAINTMARK
 - G GREEN PAINTMARK
 - ⊙ SANITARY SEWER MANHOLE
 - ⊙ MONUMENT AS NOTED
 - EDGE OF PAVEMENT
 - DOUBLE YELLOW
 - - - CONCRETE
 - x - x - CHAINLINK FENCE
 - - - - - EDGE OF GRAVEL
 - - - - - OVERHEAD UTILITY
 - - - - - FLOW LINE
 - - - - - WATERLINE

NOTE:
1. POND LINER AND SURCHARGE TO BE INSTALLED BY OTHERS.



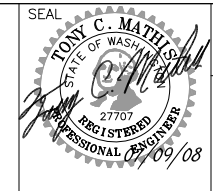
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DESIGNED: JCD
DRAWN: SCY
CHECKED: TCM
DATE: 07/10/08
SCALE: AS NOTED

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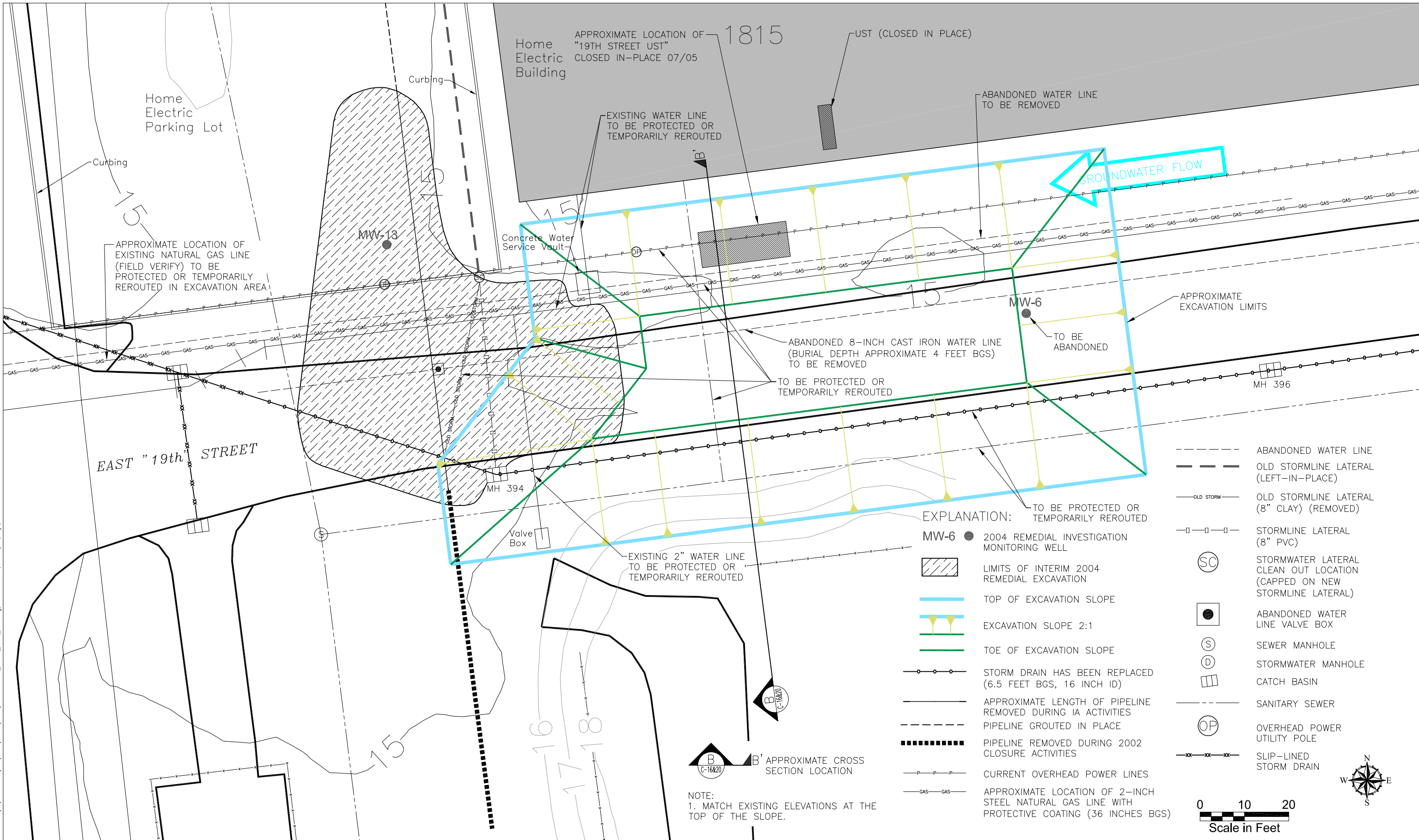
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BNSF Railway Company, Oil Pipeline Site
Tacoma, Washington

Remedial Area A Pond Subgrade Elevations /
Final Site Grade for Remedial Construction

Project No. 0506-141-02
Drawing No. C-7
Sheet 8 of 24



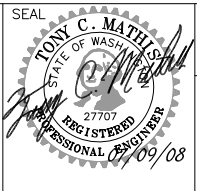
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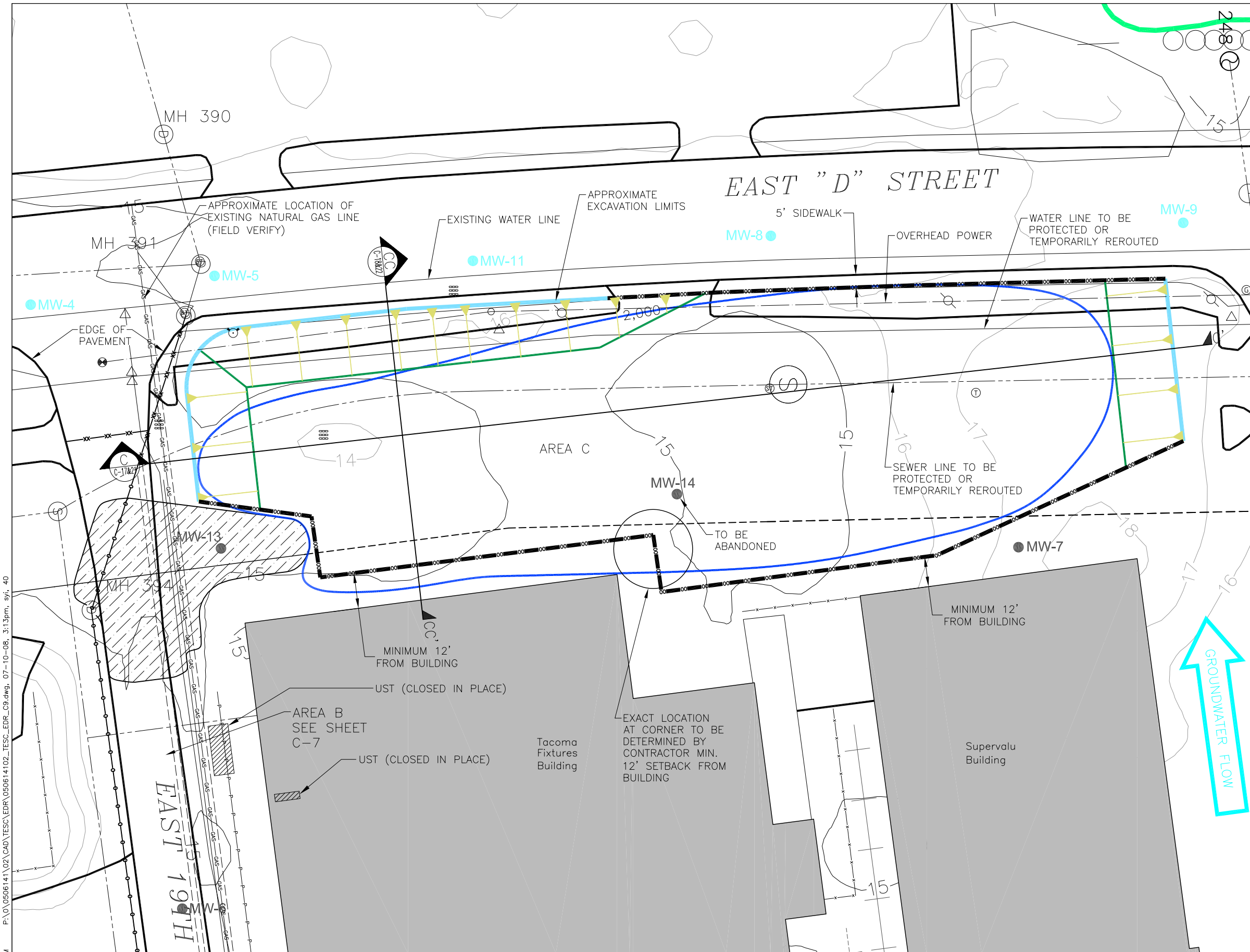
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Area B Excavation Plan

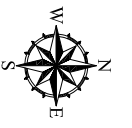
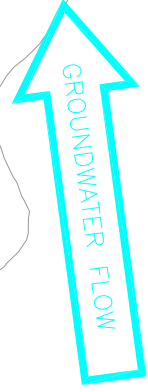
Project No. 0506-141-02
 Drawing No. C-8
 Sheet 9 of 24



- EXPLANATION:**
- MW-1 ● MONITORING WELL
 - MW-5 ● MONITORING WELL LOCATION AT THE CONDITIONAL POINTS OF COMPLIANCE
 - ⊙ STORMWATER OUTFALL
 - ⊙ SEWER MANHOLE
 - ⊙ CATCH BASIN
 - ⊙ STORMWATER MANHOLE
 - HISTORIC PIPELINE ALIGNMENT
 - PIPELINE REMOVED
 - - - PIPELINE GROUTED IN PLACE
 - x-x-x-x SLIP-LINED STORM DRAIN
 - o-o-o-o STORM DRAIN HAS BEEN REPLACED
 - ABANDONED 15-INCH SANITARY SEWER PIPE
 - ▨ LIMITS OF INTERIM REMEDIAL EXCAVATION
 - THEA FOSS SHORELINE
 - APPROXIMATE LIMIT OF CLEANUP ACTION
 - TOP OF EXCAVATION SLOPE
 - EXCAVATION SLOPE 2:1
 - TOE OF EXCAVATION SLOPE
 - SHEET PILE WALL LOCATION SEE NOTE 1
 - ⊙ APPROXIMATE CROSS SECTION LOCATION

NOTE:
1. SEE SPECIFICATIONS FOR SHEET PILE INSTALLATION REQUIREMENTS.

- LEROY SURVEY UTILITY**
- ⊙ CATCH BASIN
 - ⊙ FIRE HYDRANT
 - ⊙ STORM DRAIN MANHOLE
 - ⊙ GAS VALVE
 - ⊙ POWER POLE
 - ⊙ WATER VALVE
 - ⊙ SANITARY SEWER CLEANOUT



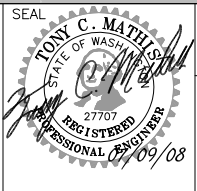
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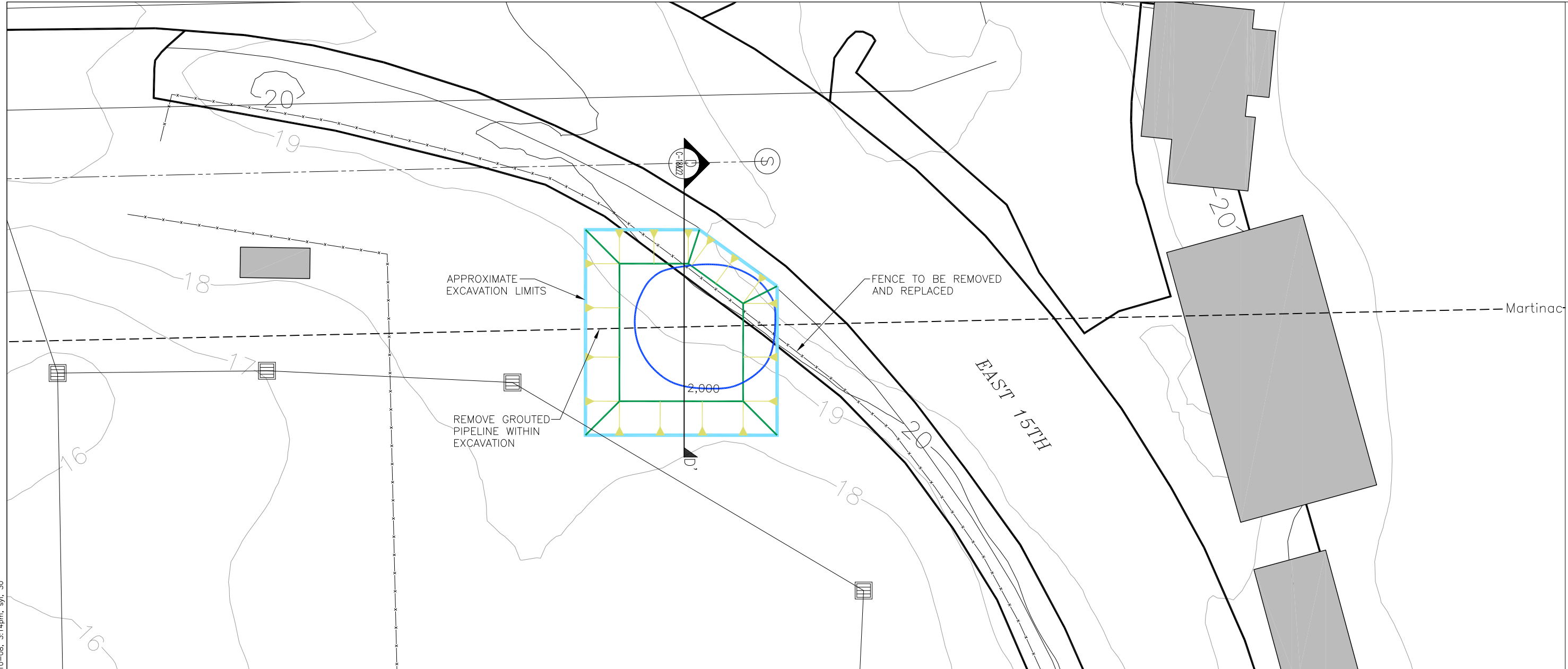
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Area C Excavation Plan

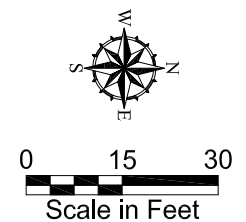
Project No. 0506-141-02
Drawing No. C-9
Sheet 10 of 24



EXPLANATION:

- TOP OF EXCAVATION SLOPE
- EXCAVATION SLOPE 2:1
- TOE OF EXCAVATION SLOPE
- APPROXIMATE LIMIT OF CLEANUP ACTION
- SEWER MANHOLE
- PIPELINE GROUTED IN PLACE
- EXISTING CHAINLINK FENCE
- APPROXIMATE CROSS SECTION LOCATION

NOTE:
1. MATCH EXISTING ELEVATIONS AT THE TOP OF THE SLOPE.



DRAFT

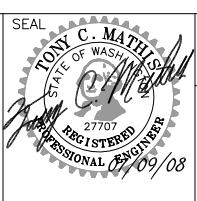
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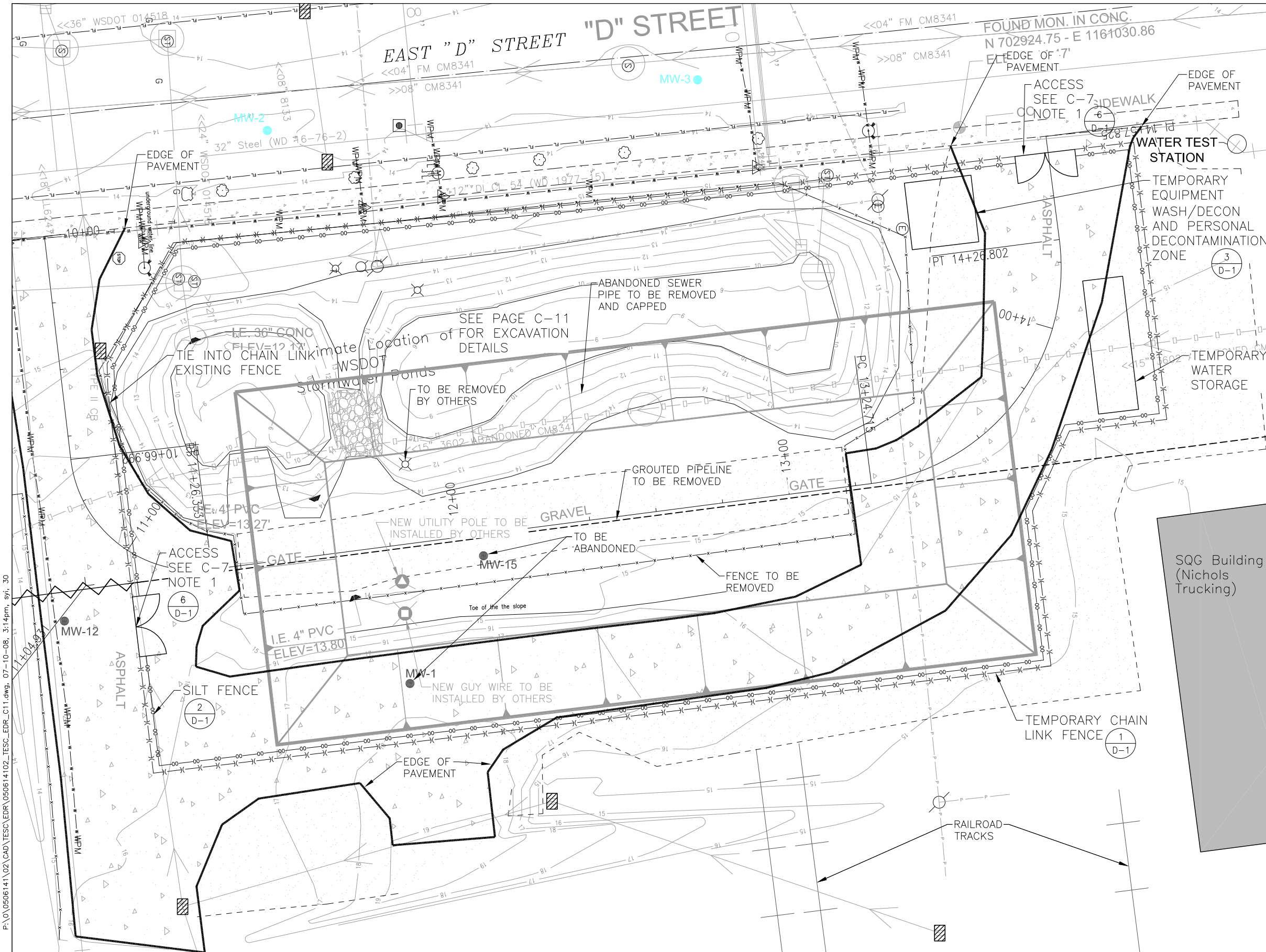


BNSF Railway Company, Oil Pipeline Site
Tacoma, Washington

Area D Excavation Plan

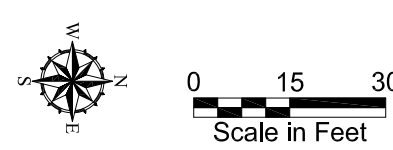
Project No. 0506-141-02
Drawing No. C-10
Sheet 11 of 24

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- EXPLANATION:**
- MW-1 ● MONITORING WELL
 - MW-5 ● MONITORING WELL LOCATION AT THE CONDITIONAL POINTS OF COMPLIANCE
 - ~ PIPELINE REMOVED
 - - - PIPELINE GROUTED IN PLACE
 - - - - - ABANDONED 15-INCH SANITARY SEWER PIPE
 - - - - - STORM DRAIN
 - - - - - SANITARY SEWER PIPE
 - ▭ REMEDIAL EXCAVATION SLOPE 2:1
 - x - x - x - TEMPORARY CHAIN LINK FENCING
 - - - - - WATTLES, SANDBAGS, AND/OR SILT FENCE
 - ⊕ IRRIGATION VALVE
 - ⊕ STOP SIGN
 - ▭ CATCH BASIN
 - ▭ INLET PROTECTION
 - ⊕ FIRE HYDRANT
 - ⊕ WATER METER
 - ⊕ STORM DRAIN MANHOLE
 - ⊕ GAS VALVE
 - ⊕ SIGN
 - ⊕ TREE
 - ⊕ POWER POLE
 - ⊕ WATER VALVE
 - ⊕ GUY ANCHOR
 - ⊕ PHONE RISER
 - ⊕ WATER MANHOLE
 - ⊕ ORANGE PAINTMARK
 - ⊕ GREEN PAINTMARK
 - ⊕ SANITARY SEWER MANHOLE
 - ⊕ MONUMENT AS NOTED
 - EDGE OF PAVEMENT
 - DOUBLE YELLOW
 - CONCRETE
 - x - x - x - CHAINLINK FENCE
 - - - - - EDGE OF GRAVEL
 - - - - - OVERHEAD UTILITY
 - - - - - FLOW LINE
 - - - - - WATERLINE
 - ▭ RIPRAP

- NOTES:**
- EROSION CONTROL WILL BE MAINTAINED IN CONSTRUCTION ACCESS POINTS WITH DIVERSION BERMS, SANDBAGS, AND/OR HAY BALES AS NEEDED. EROSION CONTROL MEASURES SHALL BE APPROVED BY THE ENGINEER PRIOR TO PLACEMENT.
 - EROSION CONTROL DEVICES SHALL BE APPROVED BY THE ENGINEER PRIOR TO PLACEMENT.
 - TIE TEMPORARY CHAIN LINK FENCE INTO EXISTING CHAIN LINK FENCE.
 - WSDOT TO REPLACE STORMWATER POND. CONSTRUCTION BYPASS TO BE INSTALLED AND OPERATED BY OTHERS.



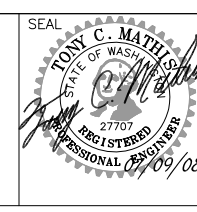
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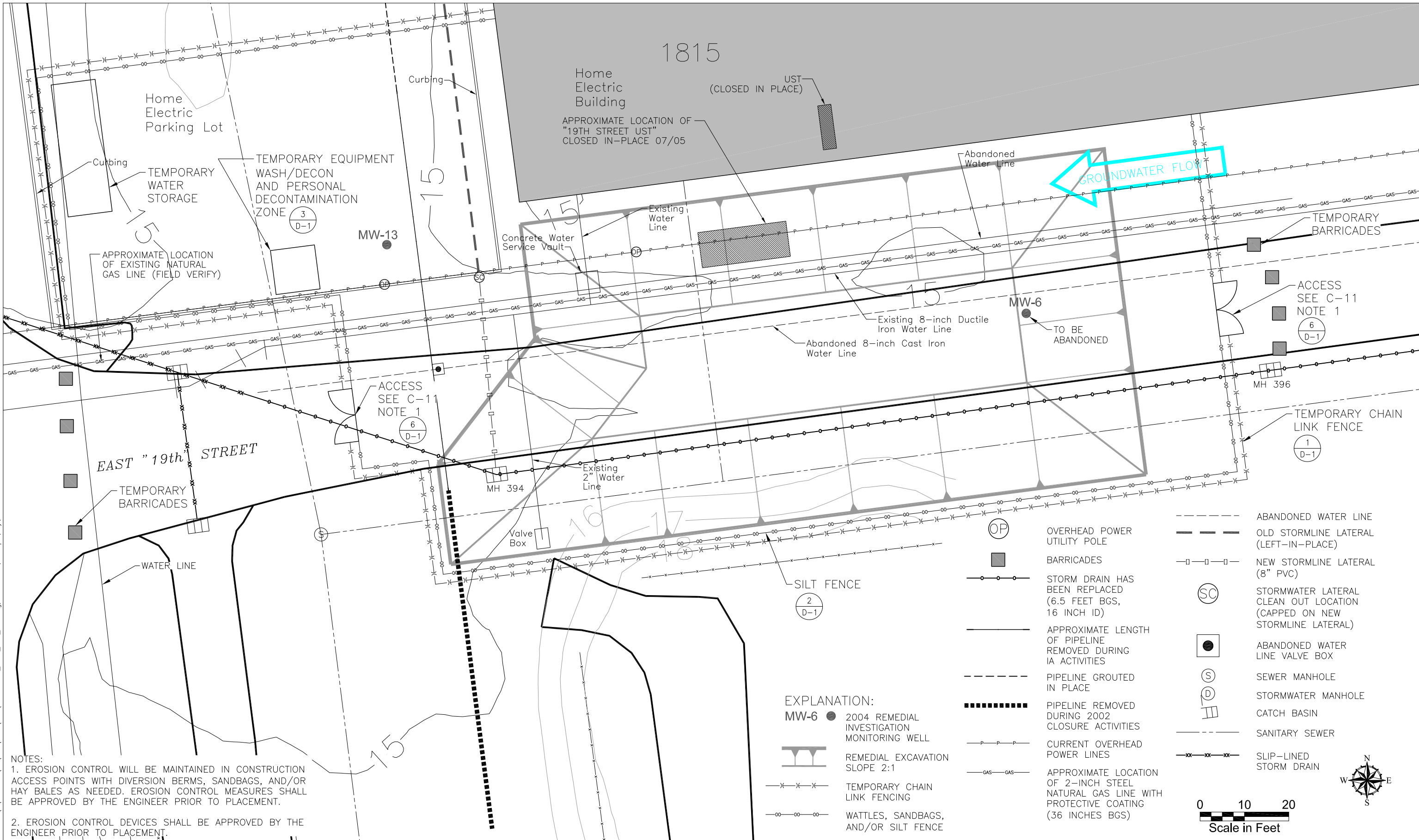
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BNSF Railway Company, Oil Pipeline Site
 Tacoma, Washington

Remedial Area A Site Control

Project No. 0506-141-02
 Drawing No. C-11
 Sheet 12 of 24



NOTES:
 1. EROSION CONTROL WILL BE MAINTAINED IN CONSTRUCTION ACCESS POINTS WITH DIVERSION BERMS, SANDBAGS, AND/OR HAY BALES AS NEEDED. EROSION CONTROL MEASURES SHALL BE APPROVED BY THE ENGINEER PRIOR TO PLACEMENT.
 2. EROSION CONTROL DEVICES SHALL BE APPROVED BY THE ENGINEER PRIOR TO PLACEMENT.

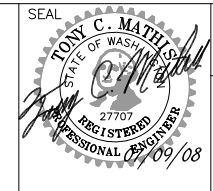
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EXPLANATION:

- MW-6 ● 2004 REMEDIAL INVESTIGATION MONITORING WELL
- REMEDIAL EXCAVATION SLOPE 2:1
- TEMPORARY CHAIN LINK FENCING
- WATTLES, SANDBAGS, AND/OR SILT FENCE
- OP OVERHEAD POWER UTILITY POLE
- BARRICADES
- STORM DRAIN HAS BEEN REPLACED (6.5 FEET BGS, 16 INCH ID)
- APPROXIMATE LENGTH OF PIPELINE REMOVED DURING IA ACTIVITIES
- PIPELINE GROUTED IN PLACE
- PIPELINE REMOVED DURING 2002 CLOSURE ACTIVITIES
- CURRENT OVERHEAD POWER LINES
- APPROXIMATE LOCATION OF 2-INCH STEEL NATURAL GAS LINE WITH PROTECTIVE COATING (36 INCHES BGS)
- ABANDONED WATER LINE
- OLD STORMLINE LATERAL (LEFT-IN-PLACE)
- NEW STORMLINE LATERAL (8" PVC)
- STORMWATER LATERAL CLEAN OUT LOCATION (CAPPED ON NEW STORMLINE LATERAL)
- ABANDONED WATER LINE VALVE BOX
- SEWER MANHOLE
- STORMWATER MANHOLE
- CATCH BASIN
- SANITARY SEWER
- SLIP-LINED STORM DRAIN

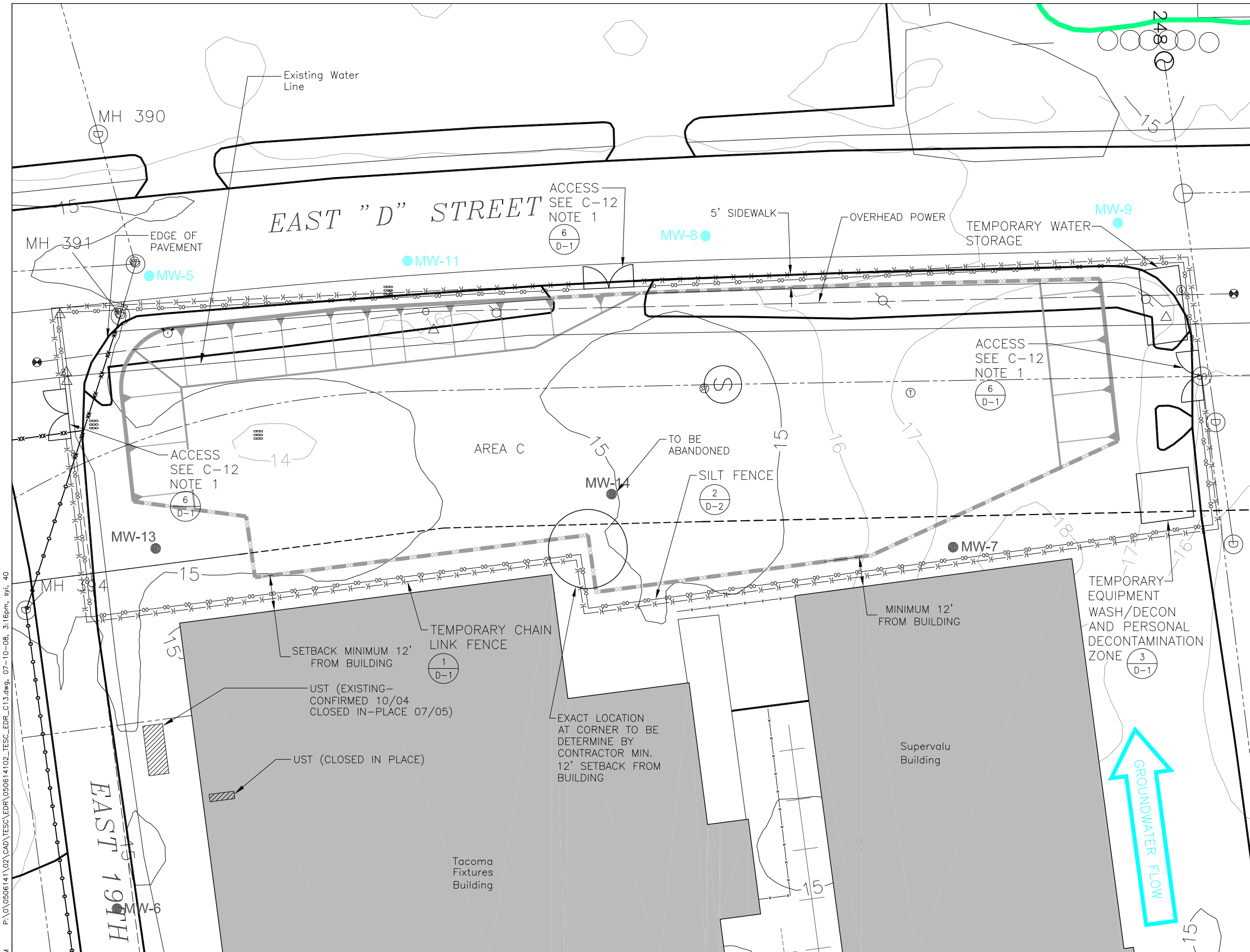
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**BNSF Railway Company, Oil Pipeline Site
 Tacoma, Washington**

Project No. 0506-141-02
 Drawing No. **C-12**
 Sheet 13 of 24

Remedial Area B Site Control

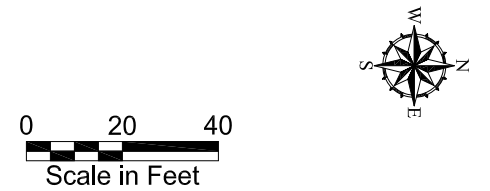
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- EXPLANATION:**
- MW-1 ● MONITORING WELL
 - MW-5 ● MONITORING WELL LOCATION AT THE CONDITIONAL POINTS OF COMPLIANCE
 - ⊙ STORMWATER OUTFALL
 - Ⓢ SEWER MANHOLE
 - ⬡ CATCH BASIN
 - Ⓧ STORMWATER MANHOLE
 - HISTORIC PIPELINE ALIGNMENT
 - - - PIPELINE REMOVED
 - - - - - PIPELINE GROUTED IN PLACE
 - x-x-x-x SLIP-LINED STORM DRAIN
 - o-o-o-o STORM DRAIN HAS BEEN REPLACED
 - ABANDONED 15-INCH SANITARY SEWER PIPE
 - THEA FOSS SHORELINE
 - REMEDIAL EXCAVATION SLOPE 2:1
 - SHEET PILE WALL LOCATION
 - x-x-x-x TEMPORARY CHAIN LINK FENCING
 - o-o-o-o WATTLES, SANDBAGS, AND/OR SILT FENCE
- LEROY SURVEY UTILITY**
- ⊙ CATCH BASIN
 - ⊙ FIRE HYDRANT
 - ⊙ STORM DRAIN MANHOLE
 - ⊙ GAS VALVE
 - ⊙ POWER POLE
 - ⊙ WATER VALVE
 - ⊙ SANITARY SEWER CLEANOUT

NOTES:

- EROSION CONTROL WILL BE MAINTAINED IN CONSTRUCTION ACCESS POINTS WITH DIVERSION BERMS, SANDBAGS, AND/OR HAY BALES AS NEEDED. EROSION CONTROL MEASURES SHALL BE APPROVED BY THE ENGINEER PRIOR TO PLACEMENT.
- EROSION CONTROL DEVICES SHALL BE APPROVED BY THE ENGINEER PRIOR TO PLACEMENT.



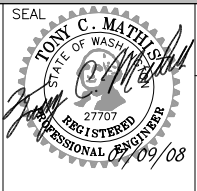
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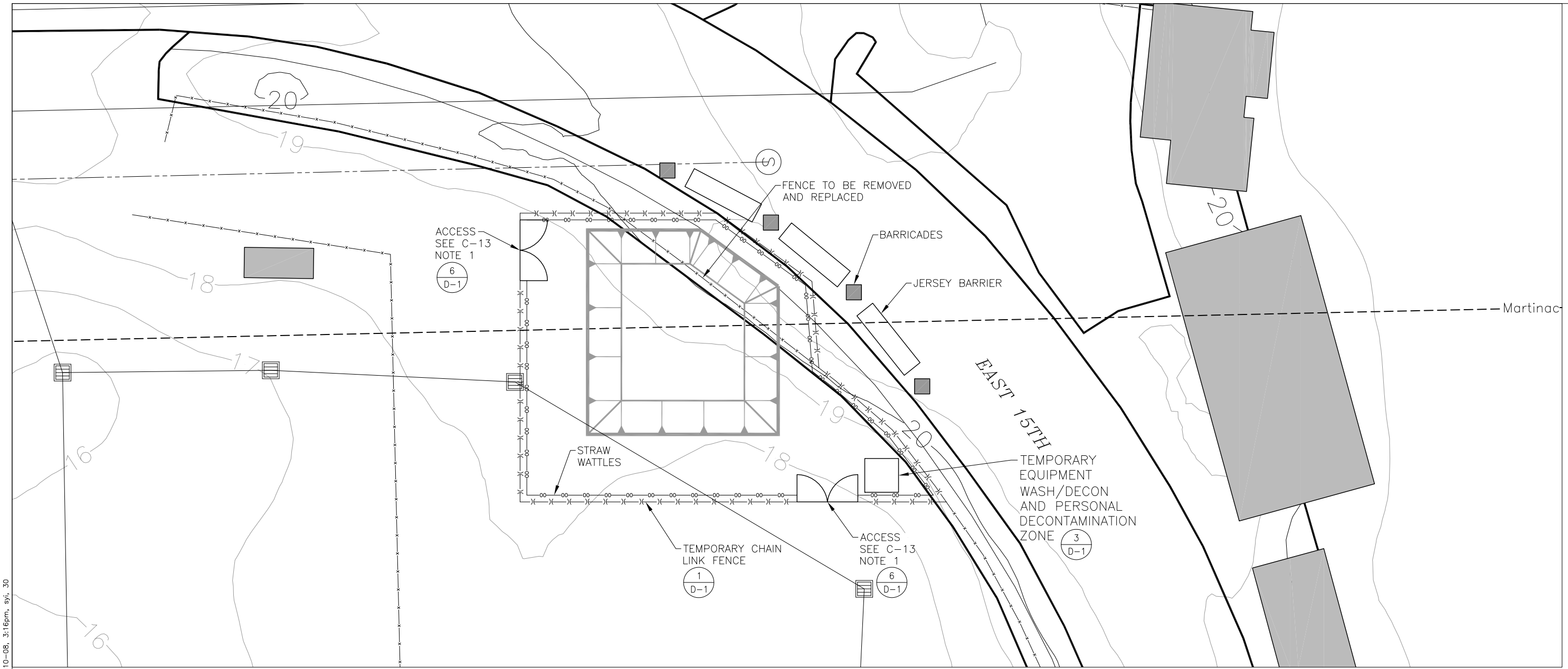


BNSF Railway Company, Oil Pipeline Site
 Tacoma, Washington

Project No. 0506-141-02
 Drawing No. **C-13**
 Sheet 14 of 24

Remedial Area C Site Control

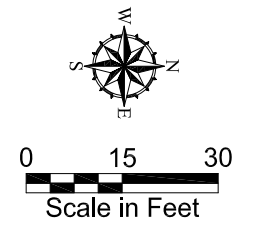
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EXPLANATION:

- | | | | |
|--|--------------------------------------|--|---------------------------|
| | REMEDIAL EXCAVATION SLOPE 2:1 | | SEWER MANHOLE |
| | TEMPORARY CHAIN LINK FENCING | | PIPELINE GROUDED IN PLACE |
| | WATTLES, SANDBAGS, AND/OR SILT FENCE | | EXISTING CHAINLINK FENCE |
| | JERSEY BARRIER | | |
| | BARRICADES | | |

- NOTES:**
1. EROSION CONTROL WILL BE MAINTAINED IN CONSTRUCTION ACCESS POINTS WITH DIVERSION BERMS, SANDBAGS, AND/OR HAY BALES AS NEEDED. EROSION CONTROL MEASURES SHALL BE APPROVED BY THE ENGINEER PRIOR TO PLACEMENT.
 2. EROSION CONTROL DEVICES SHALL BE APPROVED BY THE ENGINEER PRIOR TO PLACEMENT.
 3. TIE TEMPORARY CHAIN LINK FENCE INTO EXISTING CHAIN LINK FENCE.



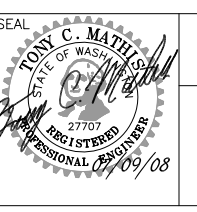
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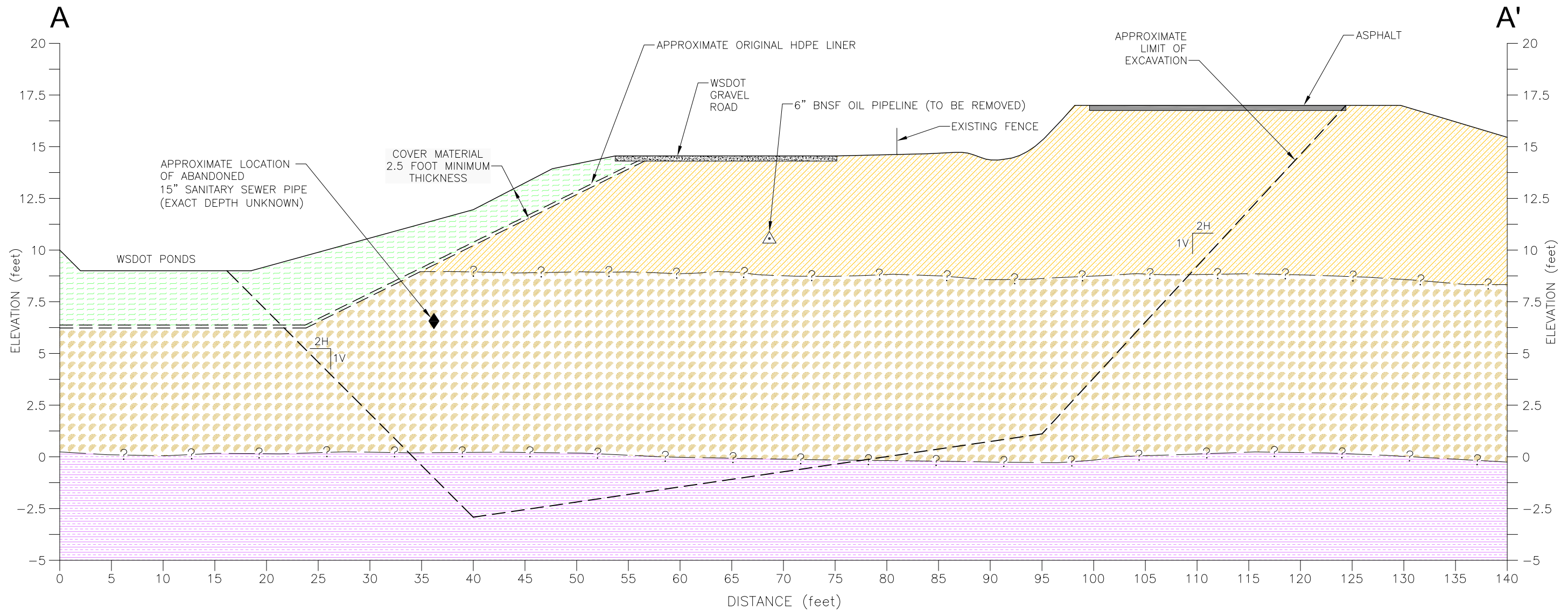


**BNSF Railway Company, Oil Pipeline Site
 Tacoma, Washington**

Remedial Area D Site Control

Project No. 0506-141-02
Drawing No. C-14
Sheet 15 of 24

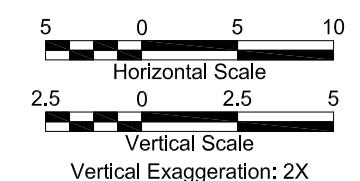
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Legend

- SOIL FILL
- WOOD WASTE FILL
- NATIVE ALLUVIUM
- WSDOT POND COVER MATERIAL
- APPROXIMATE SOIL CONTACT
- EXISTING GROUND SURFACE
- APPROXIMATE LIMIT OF EXCAVATION
- 6" BNSF OIL PIPELINE (TO BE REMOVED)
- APPROXIMATE LOCATION OF ABANDONED 15" SANITARY SEWER PIPE (EXACT DEPTH UNKNOWN)

NOTE:
 1. ALL UTILITIES SHOWN ARE APPROXIMATE. CONTRACTOR TO FIELD VERIFY.



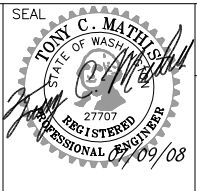
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 Reference: Drawing created from sketch provided by GeoEngineers' personnel.

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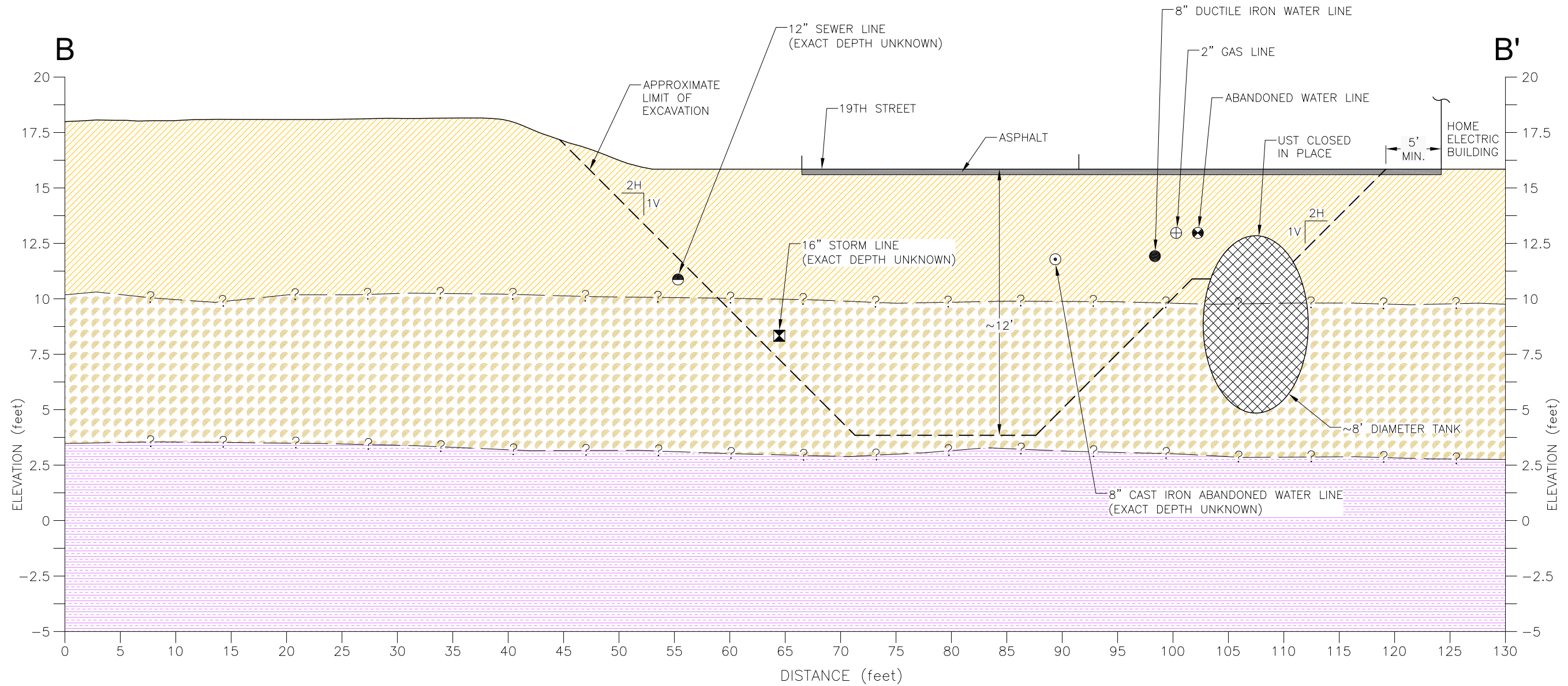


BNSF Railway Company, Oil Pipeline Site
 Tacoma, Washington

Remedial Area A Cross Section A-A' (Pre Excavation)

Project No. 0506-141-02
 Drawing No. C-15
 Sheet 16 of 24

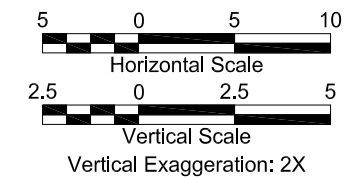
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Legend

- | | | | | | | | |
|--|-----------------|--|---------------------------------|--|---|--|--------------------------------------|
| | SOIL FILL | | APPROXIMATE SOIL CONTACT | | 8" DUCTILE IRON WATER LINE | | 16" STORM LINE (EXACT DEPTH UNKNOWN) |
| | WOOD WASTE FILL | | EXISTING GROUND SURFACE | | 8" CAST IRON ABANDONED WATER LINE (EXACT DEPTH UNKNOWN) | | 12" SEWER LINE (EXACT DEPTH UNKNOWN) |
| | NATIVE ALLUVIUM | | APPROXIMATE LIMIT OF EXCAVATION | | 2" GAS LINE | | ABANDONED WATER LINE |

NOTE:
 1. ALL UTILITIES SHOWN ARE APPROXIMATE. CONTRACTOR TO FIELD VERIFY.



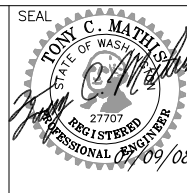
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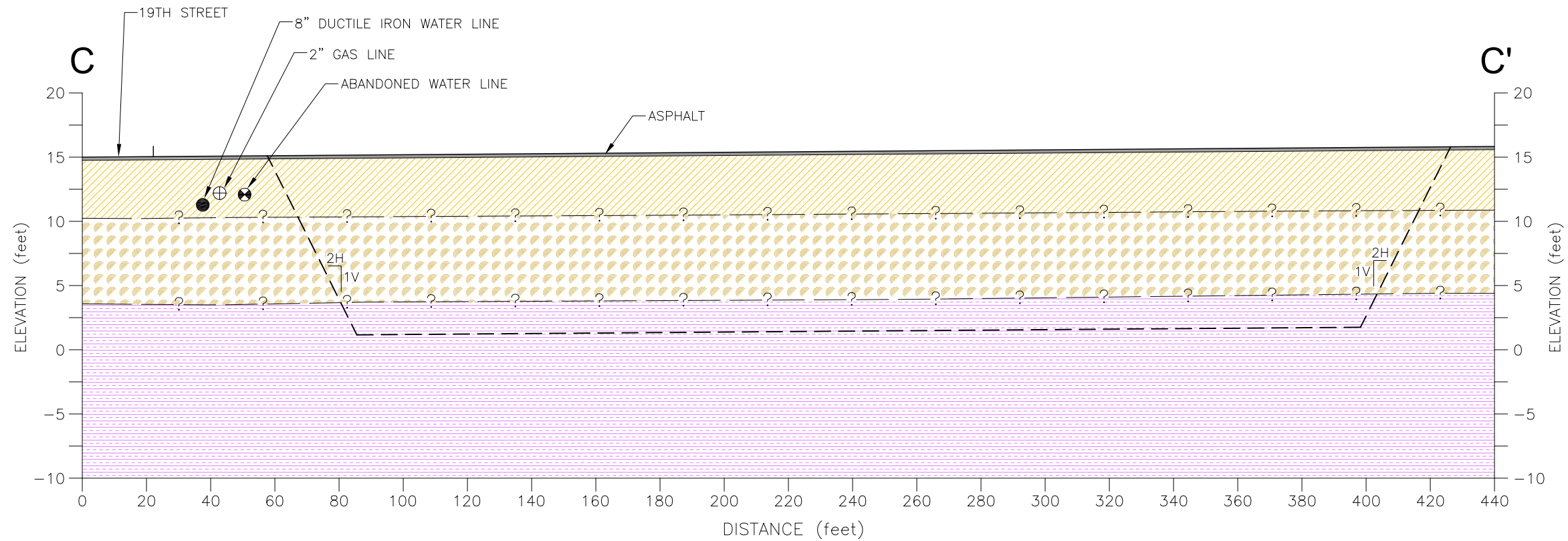


BNSF Railway Company, Oil Pipeline Site
 Tacoma, Washington

Remedial Area B Cross Section B-B' (Pre Excavation)

Project No. 0506-141-02
 Drawing No. **C-16**
 Sheet 17 of 24

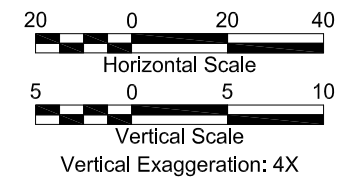
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Legend

- SOIL FILL
- WOOD WASTE FILL
- NATIVE ALLUVIUM
- APPROXIMATE SOIL CONTACT
- EXISTING GROUND SURFACE
- APPROXIMATE LIMIT OF EXCAVATION
- 8" DUCTILE IRON WATER LINE
- 2" GAS LINE
- ABANDONED WATER LINE

NOTE:
1. ALL UTILITIES SHOWN ARE APPROXIMATE. CONTRACTOR TO FIELD VERIFY.



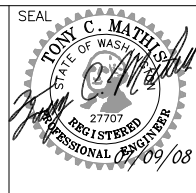
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2. This figure is for informational purposes only. It is intended to assist in the identification of features discussed in a related document. Data were compiled from sources as listed in this figure. The data sources do not guarantee these data are accurate or complete. There may have been updates to the data since the publication of this figure. This figure is a copy of a master document. The master hard copy is stored by GeoEngineers, Inc. and will serve as the official document of record.
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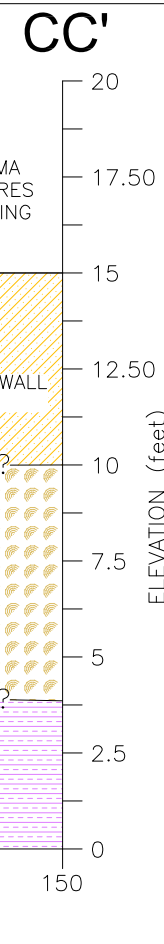
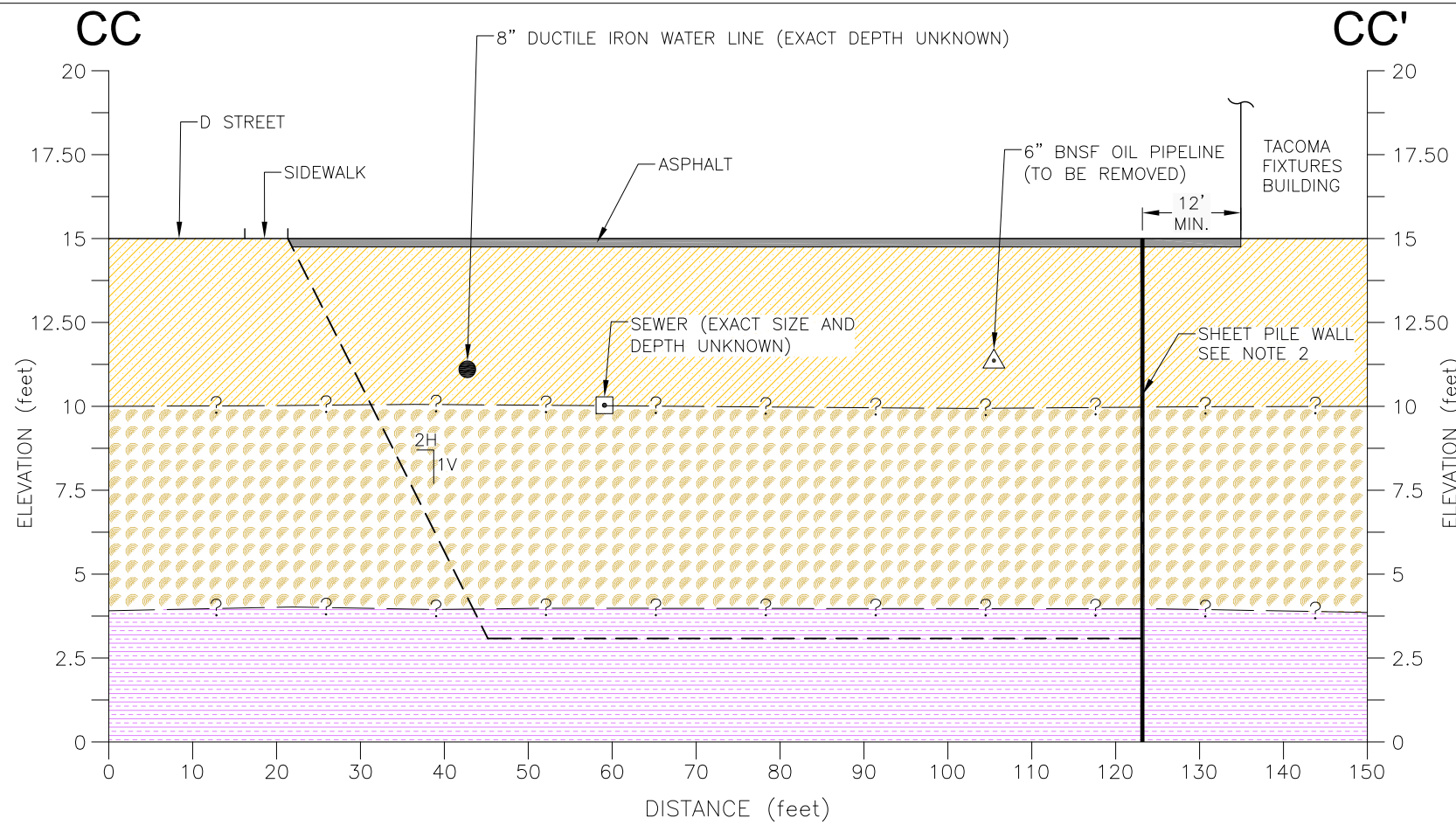
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Tacoma, Washington

Remedial Area C Cross Section C-C' (Pre Excavation)

Project No. 0506-141-02
Drawing No. **C-17**
Sheet 18 of 24

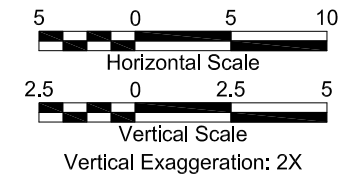
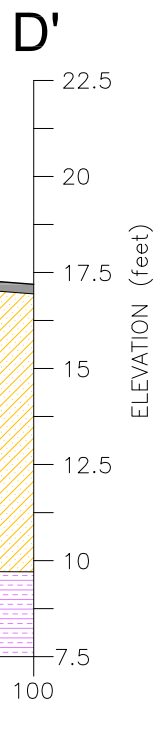
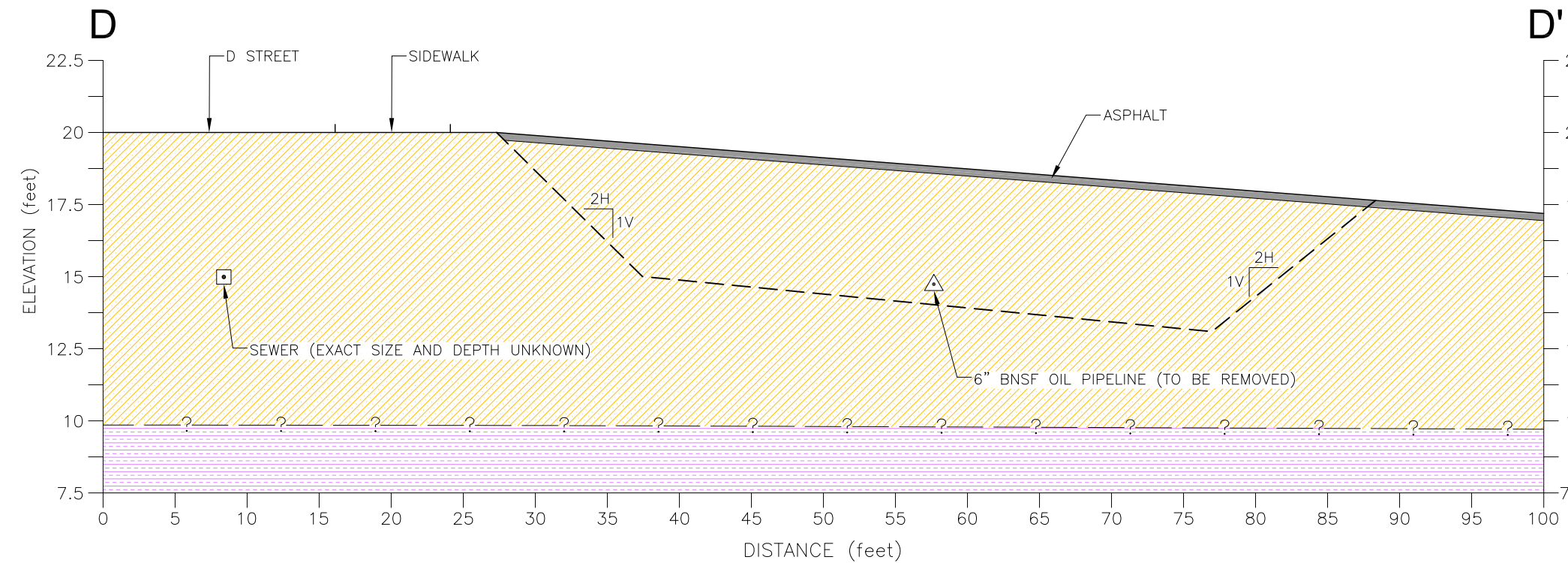
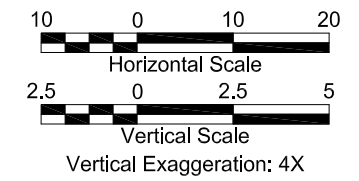


Legend

- SOIL FILL
- WOOD WASTE FILL
- NATIVE ALLUVIUM
- APPROXIMATE SOIL CONTACT
- EXISTING GROUND SURFACE
- APPROXIMATE LIMIT OF EXCAVATION
- 8" DUCTILE IRON WATER LINE (EXACT DEPTH UNKNOWN)
- 6" BNSF OIL PIPELINE (TO BE REMOVED)
- SEWER (EXACT SIZE AND DEPTH UNKNOWN)

NOTES:

- ALL UTILITIES SHOWN ARE APPROXIMATE. CONTRACTOR TO FIELD VERIFY.
- SHEET PILE SHORING TO BE LEFT IN PLACE.



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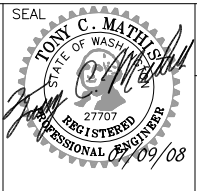
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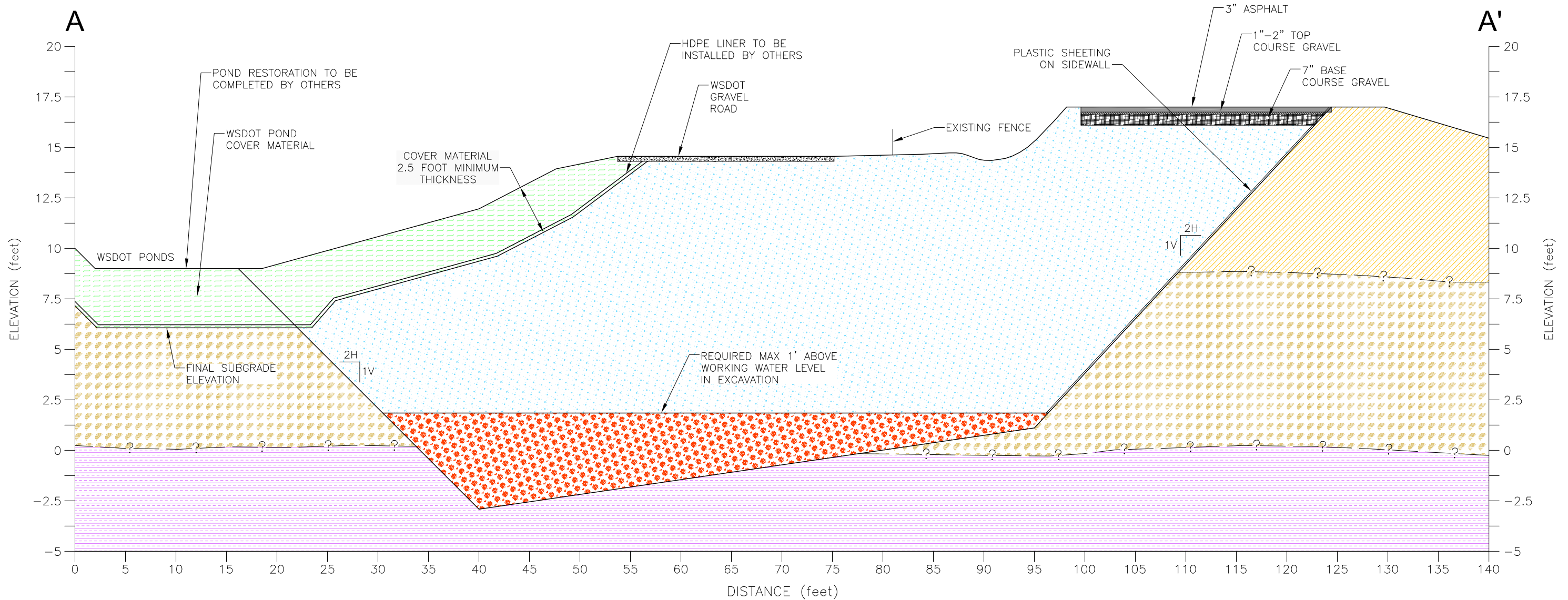


BNSF Railway Company, Oil Pipeline Site
 Tacoma, Washington

Remedial Area C and D Cross Sections
 CC-CC' and D-D' (Pre Excavation)

Project No. 0506-141-02
 Drawing No. **C-18**
 Sheet 19 of 24

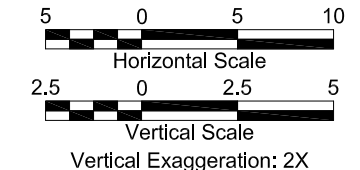
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 OFFICE:TACO PM EWH:jcd



Legend

- SOIL FILL
- BANK RUN GRAVEL WSDOT 9-03.19
- EXISTING GROUND SURFACE
- WOOD WASTE FILL
- GRAVEL BALLAST WSDOT 9-03.9 (1)
- APPROXIMATE SOIL CONTACT
- NATIVE ALLUVIUM
- WSDOT POND COVER MATERIAL

- NOTES:**
1. ALL UTILITIES SHOWN ARE APPROXIMATE. CONTRACTOR TO FIELD VERIFY.
 2. EXCAVATION TO BE BACKFILLED TO FINAL SUBGRADE ELEVATION.
 3. SUBGRADE SURFACE ID MEET SURFACE FINISH REQUIREMENTS FOR HDPE LINER INSTALLATION.
 4. FINAL SUBGRADE ELEVATIONS FOR POND AREA TO MATCH EXISTING POND SUBGRADE ELEVATIONS.



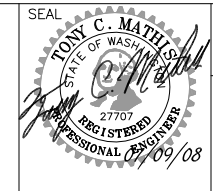
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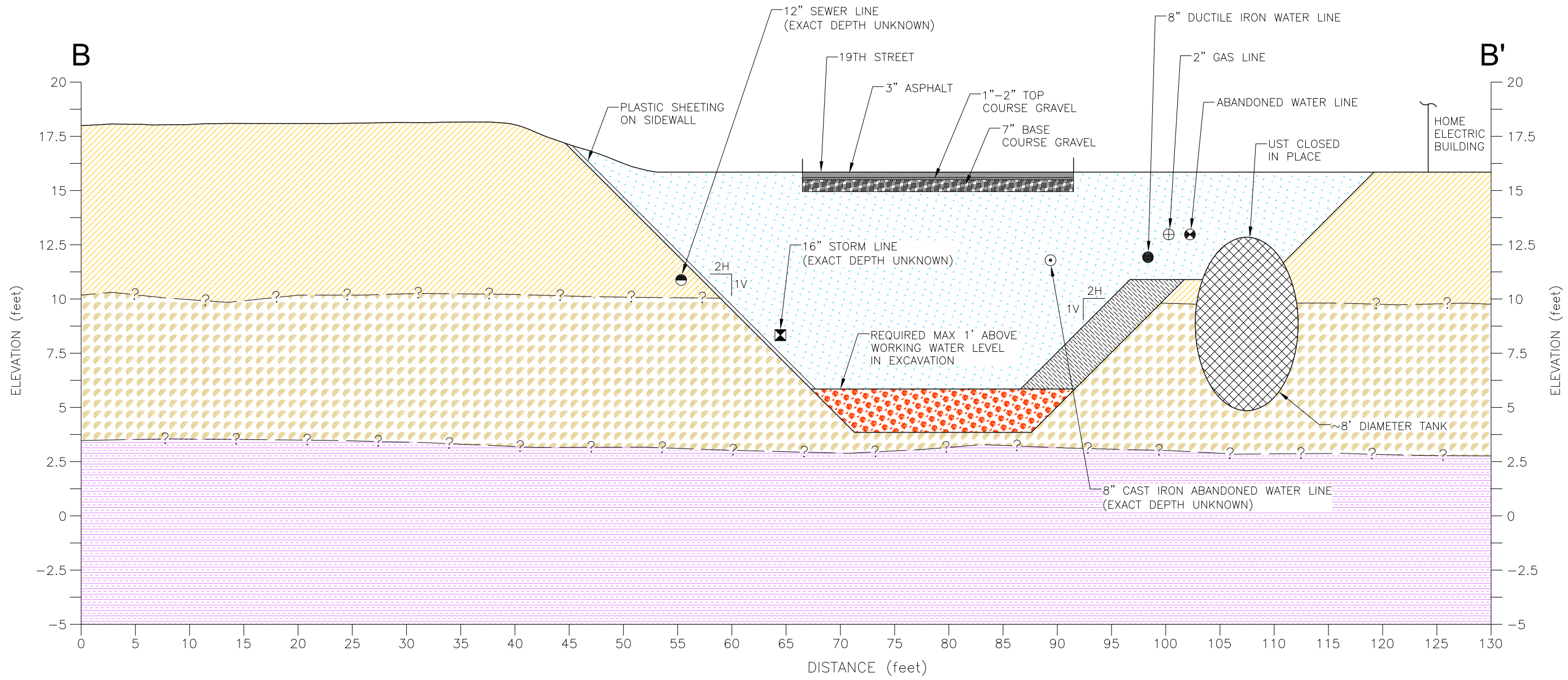


BNSF Railway Company, Oil Pipeline Site
 Tacoma, Washington

Remedial Area A Cross Section A-A' (Post Excavation)

Project No. 0506-141-02
 Drawing No. C-19
 Sheet 20 of 24

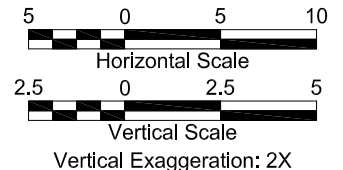
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Legend

- | | | | | |
|-----------------|---|--------------------------|---|--------------------------------------|
| SOIL FILL | BANK RUN GRAVEL WSDOT 9-03.19 | EXISTING GROUND SURFACE | 8" DUCTILE IRON WATER LINE | 16" STORM LINE (EXACT DEPTH UNKNOWN) |
| WOOD WASTE FILL | GRAVEL BALLAST WSDOT 9-03.9 (1) | APPROXIMATE SOIL CONTACT | 8" CAST IRON ABANDONED WATER LINE (EXACT DEPTH UNKNOWN) | 12" SEWER LINE (EXACT DEPTH UNKNOWN) |
| NATIVE ALLUVIUM | SOIL WITH MINIMUM 5% TOTAL ORGANIC CARBON | | 2" GAS LINE | ABANDONED WATER LINE |

NOTE:
 1. ALL UTILITIES SHOWN ARE APPROXIMATE. CONTRACTOR TO FIELD VERIFY.



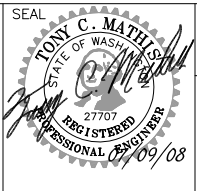
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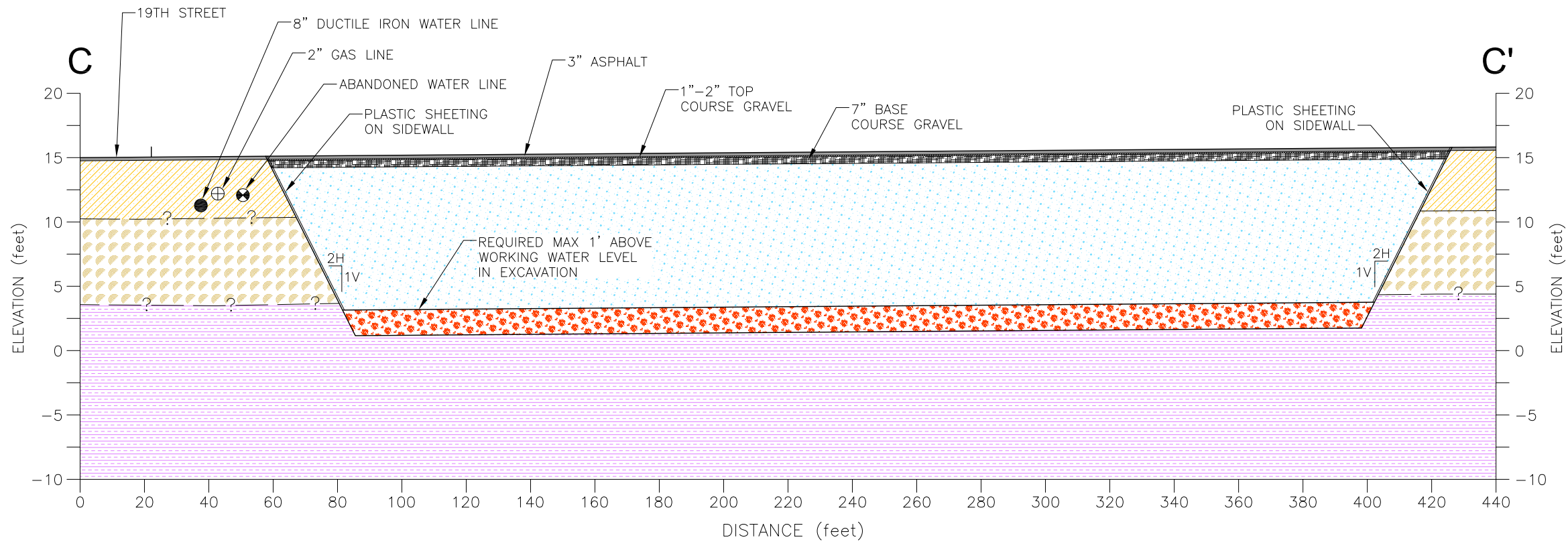


BNSF Railway Company, Oil Pipeline Site
 Tacoma, Washington

Remedial Area B Cross Section B-B' (Post Excavation)

Project No. 0506-141-02
 Drawing No. C-20
 Sheet 21 of 24

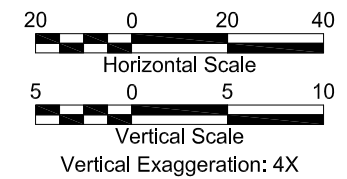
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Legend

- SOIL FILL
- WOOD WASTE FILL
- NATIVE ALLUVIUM
- BANK RUN GRAVEL WSDOT 9-03.19
- GRAVEL BALLAST WSDOT 9-03.9 (1)
- APPROXIMATE SOIL CONTACT
- EXISTING GROUND SURFACE
- APPROXIMATE LIMIT OF EXCAVATION
- 8" DUCTILE IRON WATER LINE
- 2" GAS LINE
- ABANDONED WATER LINE

NOTE:
1. ALL UTILITIES SHOWN ARE APPROXIMATE. CONTRACTOR TO FIELD VERIFY.



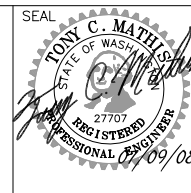
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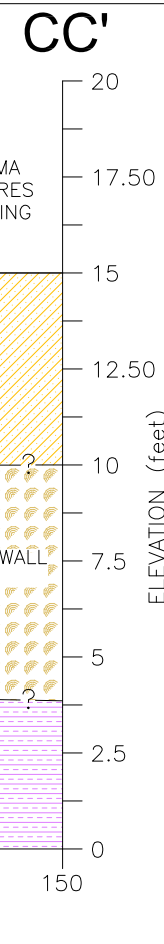
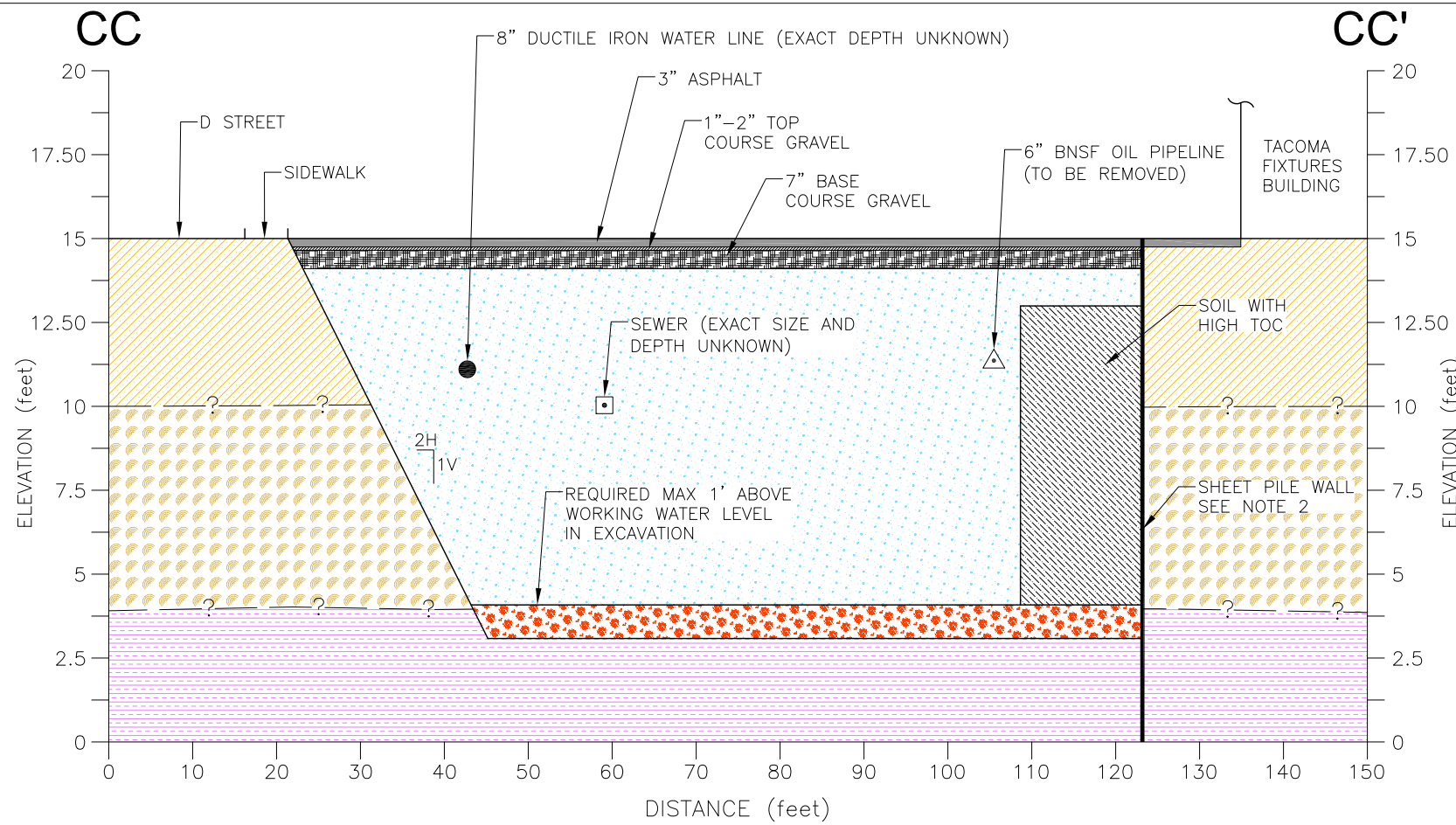
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Tacoma, Washington

Remedial Area C Cross Section C-C' (Post Excavation)

Project No. 0506-141-02
Drawing No. C-21
Sheet 22 of 24



Legend

- SOIL FILL
- WOOD WASTE FILL
- NATIVE ALLUVIUM
- BANK RUN GRAVEL WSDOT 9-03.19
- GRAVEL BALLAST WSDOT 9-03.9 (1)
- SOIL WITH MINIMUM 5% TOTAL ORGANIC CARBON
- APPROXIMATE SOIL CONTACT
- EXISTING GROUND SURFACE
- 8" DUCTILE IRON WATER LINE (EXACT DEPTH UNKNOWN)
- 6" BNSF OIL PIPELINE (TO BE REMOVED)
- SEWER (EXACT SIZE AND DEPTH UNKNOWN)

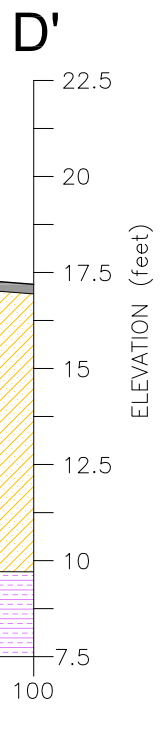
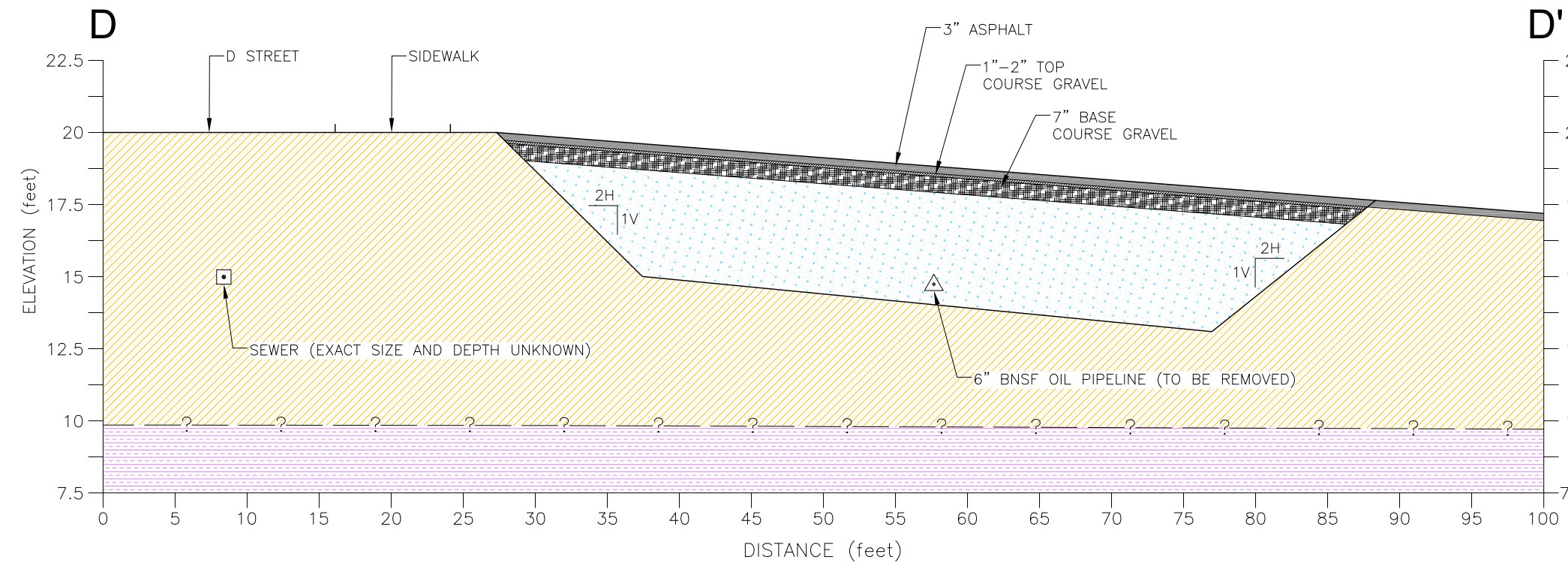
NOTES:

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10 0 10 20
Horizontal Scale

2.5 0 2.5 5
Vertical Scale

Vertical Exaggeration: 4X



5 0 5 10
Horizontal Scale

2.5 0 2.5 5
Vertical Scale

Vertical Exaggeration: 2X

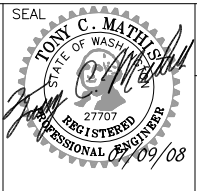
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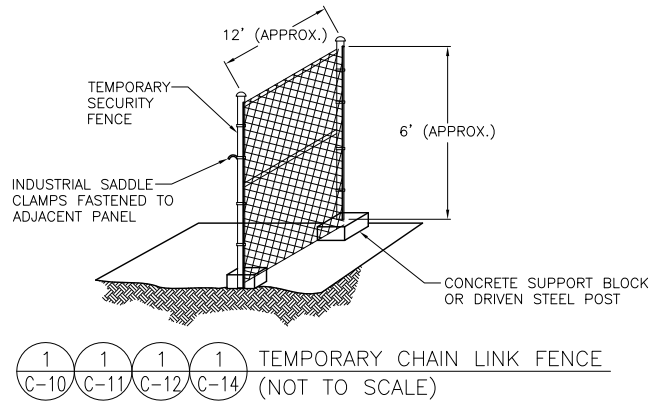


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Tacoma, Washington

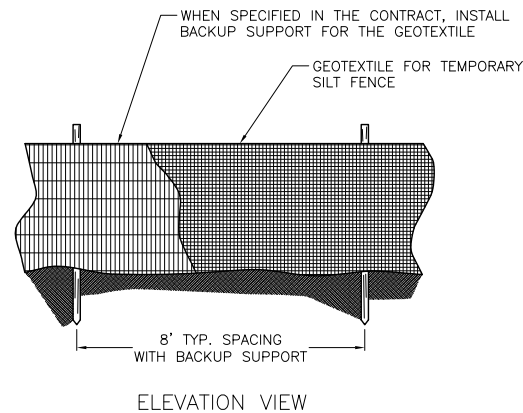
Remedial Area C and D Cross Sections
CC-CC' and D-D' (Post Excavation)

Project No. 0506-141-02
Drawing No. C-22
Sheet 23 of 24

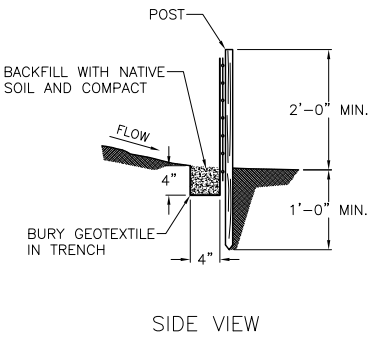
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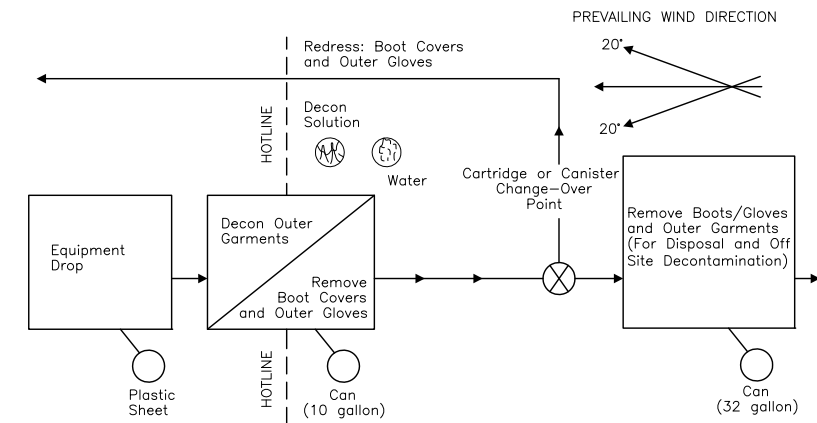
1 1 1 1 TEMPORARY CHAIN LINK FENCE
C-10 C-11 C-12 C-14 (NOT TO SCALE)



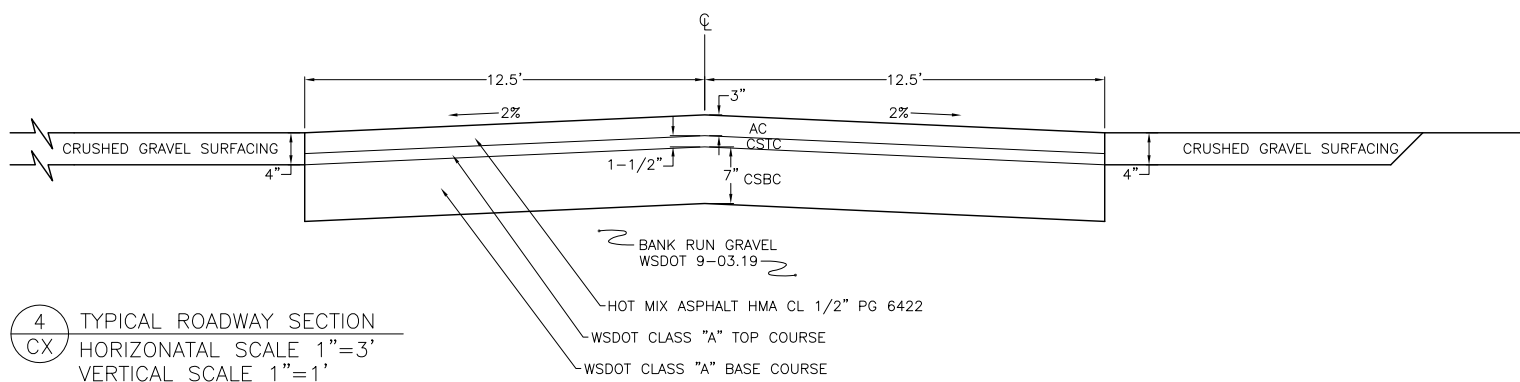
2 2 2 SILT FENCE
C-10 C-11 C-12 (NOT TO SCALE)



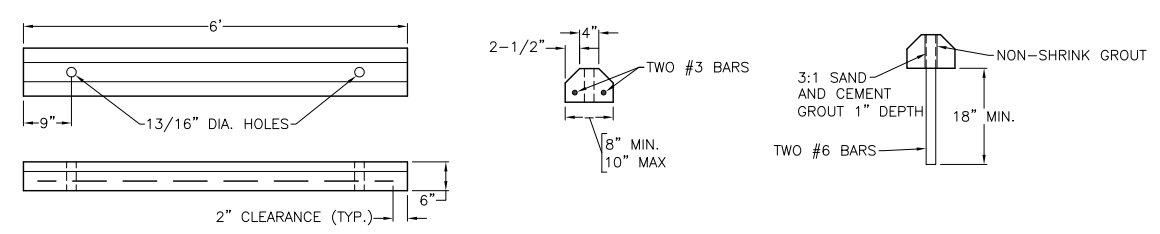
SIDE VIEW



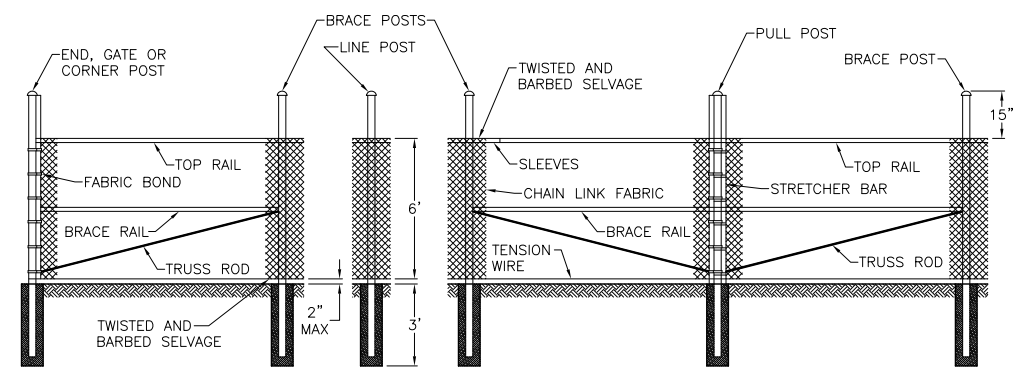
3 3 3 3 DECONTAMINATION ZONE LAYOUT
C-10 C-11 C-12 C-13 (NOT TO SCALE)



4 TYPICAL ROADWAY SECTION
CX HORIZONTAL SCALE 1"=3'
VERTICAL SCALE 1"=1'



5 TYPICAL PRECAST CONCRETE BUMPER CURB
CX (NOT TO SCALE)



6 6 6 6 PERMANENT CHAIN LINK FENCE
C-10 C-11 C-12 C-13 (NOT TO SCALE)

		MEMBER																	
		BRACE RAIL & TOP RAIL			LINE & BRACE POST						END, CORNER, & PULL POST		GATE POST		ALL POSTS				
TYPE		ROUND	H-COLUMN	ROLL FORMED	ROUND	H-COLUMN	ROLL FORMED	ROUND	ROLL FORMED	ROUND	ROLL FORMED	ROUND	ROLL FORMED	ROUND	LENGTH				
	I.D. PIPE (INCHES)	WEIGHT PER FOOT (POUNDS)	SIZE (INCHES)	WEIGHT PER FOOT (POUNDS)	SIZE (INCHES)	WEIGHT PER FOOT (POUNDS)	SIZE (INCHES)	WEIGHT PER FOOT (POUNDS)	SIZE (INCHES)	WEIGHT PER FOOT (POUNDS)	SIZE (INCHES)	WEIGHT PER FOOT (POUNDS)	SIZE (INCHES)	I.D. PIPE (INCHES)	WEIGHT PER FOOT (POUNDS)				
	1-1/4	2.27	1-1/4 x 1-5/8	1.35	1-5/8 x 1-1/4	1.35	2	3.65	2-1/4	4.00	1-5/8 x 1-1/4	2.34	2-1/2	5.79	3-1/2 x 3-1/2	5.14	3-1/2	9.1	8'-8"

PERMANENT CHAIN LINK FENCE SCHEDULE

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	DATE: 07/10/08				
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27707
REGISTERED PROFESSIONAL ENGINEER
09/08

423 East Second Ave.
Spokane, WA 99202
Telephone (509) 363-3125
Fax (509) 363-3126

**BNSF Railway Company, Oil Pipeline Site
Tacoma, Washington**

Construction Details

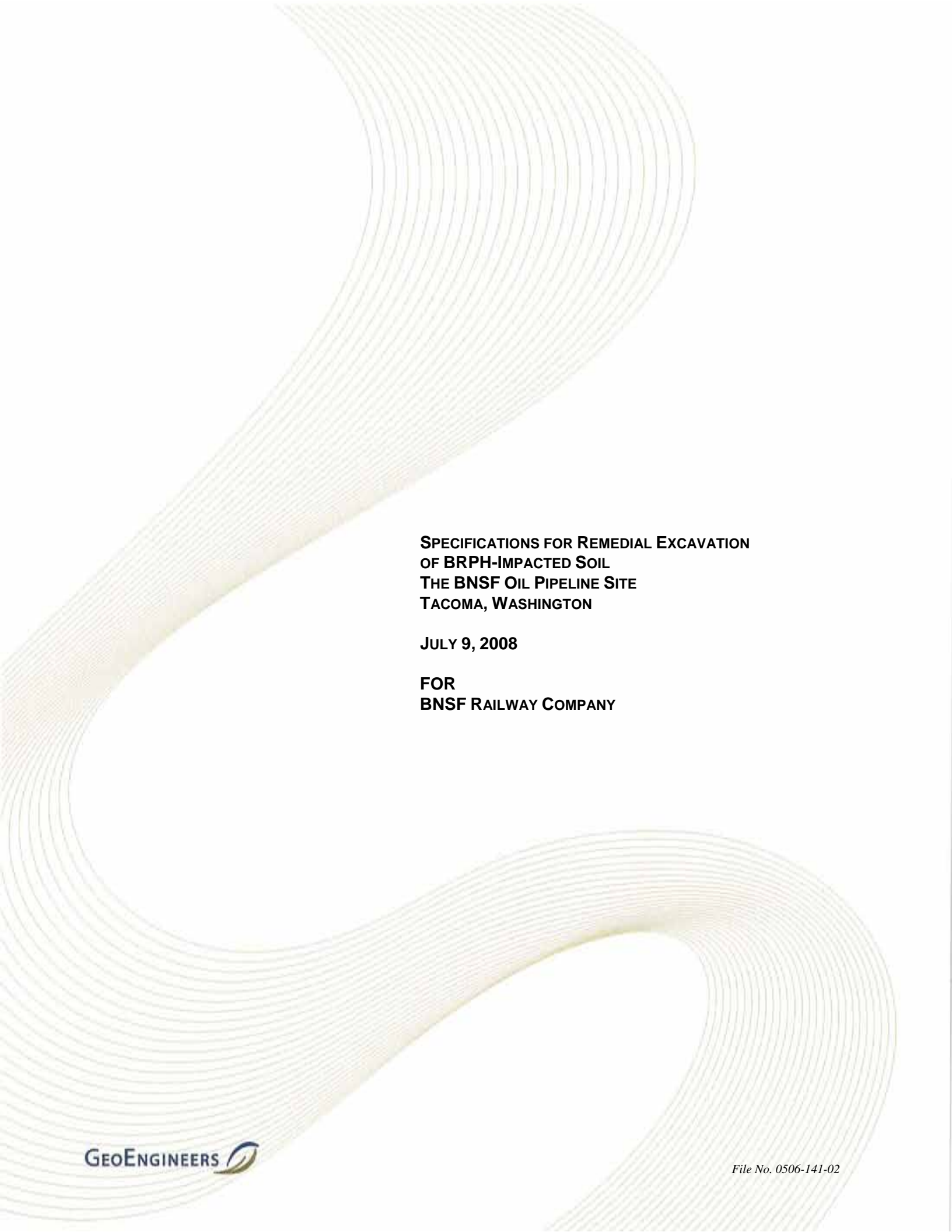
Project No. 0506-141-02
Drawing No. D-1
Sheet 24 of 24

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APPENDIX B
SPECIFICATIONS





**SPECIFICATIONS FOR REMEDIAL EXCAVATION
OF BRPH-IMPACTED SOIL
THE BNSF OIL PIPELINE SITE
TACOMA, WASHINGTON**

JULY 9, 2008

**FOR
BNSF RAILWAY COMPANY**

TABLE OF CONTENTS

	<u>Page No.</u>
ACRONYMS	iii
1.0 INTRODUCTION AND SITE HISTORY	1
1.1 INSTRUCTIONS TO CONTRACTOR	1
1.2 CONTRACTOR SITE WALK AND COORDINATION MEETING	7
1.3 BID SUBMITTAL DUE DATE	7
1.4 BID SUBMITTAL FORMAT	7
1.5 PROPOSED CHANGES, EXCEPTIONS AND MODIFICATIONS	8
1.6 BID EVALUATION CRITERIA	8
1.7 BID COST FORM	9
1.8 FINAL BID SUBMITTAL	9
1.9 CONSTRUCTION CONTRACT AND GENERAL CONDITIONS	9
1.10 MEASUREMENT AND PAYMENT	9
1.10.1 Measurement	9
1.10.2 Payment	10
1.10.3 Schedule	11
1.11 LIQUIDATED DAMAGES	11
1.12 PERFORMANCE/PAYMENT BONDS	11
2.0 CONTACTS/ROLES	12
2.1 OWNER	12
2.2 ENGINEER	12
2.3 WASHINGTON STATE DEPARTMENT OF ECOLOGY	12
3.0 REFERENCES	13
4.0 COORDINATION OF OPERATIONS	13
5.0 REGULATIONS AND PERMITS	13
6.0 UTILITIES	14
7.0 SAFETY	14
8.0 PROJECT SUPERVISION	15
8.1 CONTRACTOR'S SUPERVISION	15
8.2 JOB SITE ADMINISTRATION	15
9.0 SITE WORK	16
9.1 MOBILIZATION AND DEMOBILIZATION	16
9.2 SITE PREPARATION	16
9.2.1 Temporary Facilities and Site Controls	16
9.2.2 Temporary Erosion and Sedimentation Controls (TESC)	18
9.2.3 Standard Specifications	20
9.2.4 Saw Cutting and Removal of Pavement	20
9.2.5 Water Supplied from Hydrants	20
9.3 STRUCTURAL SHORING	21
9.4 EXCAVATION OF CONTAMINATED AND UNCONTAMINATED MATERIALS	22
9.5 LOADING AND COORDINATION OF IMPACTED MATERIALS DISPOSAL	23

TABLE OF CONTENTS (CONTINUED)

	<u>Page No.</u>
9.6 BACKFILLING AND GRADING	24
9.7 IMPACTED WATER COLLECTION AND DISPOSAL.....	26
10.0 SUBMITTALS.....	26
10.1 SITE WORK RELATED SUBMITTALS.....	27
10.2 HEALTH AND SAFETY PLAN.....	27
10.2.1 Contractor’s Responsibility for Health and Safety.....	28
10.2.2 Contractor’s Health and Safety Submittals	29
10.2.3 Notifications	30
10.2.4 Training Requirements	30
10.2.5 Work Planning and Meetings	31
10.2.6 Engineering Controls.....	31
10.2.7 Monitoring.....	31
10.2.8 Personal Protective Equipment (PPE)	31
10.2.9 Other Health and Safety Equipment.....	32
10.2.10 Evaluation of Performance	33
10.3 EXCLUSION ZONE PLAN.....	33
10.4 POST-REMEDATION SUBMITTALS	34

List of Tables

Table 1. Cost Proposal Form – Area A.....	3
Table 2. Cost Proposal Form – Area B.....	4
Table 3. Cost Proposal Form – Area C.....	5
Table 4. Cost Proposal Form – Area D.....	6
Table 5. Contractor Submittals	27

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ACRONYMS

AASHTO	American Association of State Highway and Transportation Officials
ACGIH	American Conference of Governmental Industrial Hygienists
APWA	American Public Works Association
ASTM	American Society of Testing and Materials
bgs	below ground surface
BNRR	Burlington Northern Railroad
BNSF	Burlington Northern Santa Fe Railway Company
CAP	Cleanup Action Plan
cy	cubic yards
Ecology	Washington State Department of Ecology
EDNA	Environmental Designation for Noise Abatement
EDR	Engineering Design Report
EMR	Worker's Compensation Experience Modification Rate
EPA	Environmental Protection Agency
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations
HDPE	high-density polyethylene
JSHA	Job Safety and Hazard Analysis
L&I	Washington State Department of Labor and Industries
MBFM	Mechanically Bonded Fiber Matrix
MDD	maximum dry density
mg/kg	milligrams per kilogram
MTCA	Model Toxics Control Act
NIOSH	National Institute of Occupational Safety and Health
OSHA	Occupational Safety and Health Administration

PPE	personal protection equipment
RI/FS	Remedial Investigation/Feasibility Study
SSHO	Site Safety and Health Officer
STAR	Safety Task Analysis Review
SWPPP	Storm Water Pollution Prevention Plan
TESC	Temporary Erosion and Sedimentation Control
WAC	Washington Administrative Code
WISHA	Washington Industrial Safety and Health Act
WSDOT	Washington State Department of Transportation

**SPECIFICATIONS FOR REMEDIAL EXCAVATION OF BRPH-IMPACTED SOIL
THE BNSF OIL PIPELINE SITE
TACOMA, WASHINGTON
FOR
BNSF RAILWAY COMPANY**

1.0 INTRODUCTION AND SITE HISTORY

The contractor must refer to the Engineering Design Report, "The BNSF Oil Pipeline Site, Tacoma, Washington" for a detailed description of Site history and conditions.

1.1 INSTRUCTIONS TO CONTRACTOR

The work to be performed shall include furnishing all labor, materials and equipment necessary to complete remediation of contaminated materials at the Site. All work will be directly contracted by GeoEngineers, Inc. (Engineer), and the Engineer shall serve as the Owner's on-site representative. The general tasks necessary to complete the work include, but are not limited to the following:

- Site preparation such as installing temporary facilities and site controls; installing temporary erosion and sedimentation controls; protecting existing utilities; saw cutting and removing existing asphalt; installing structural shoring; excavating contaminated and uncontaminated soil and materials; loading, hauling and disposal of contaminated soil and materials; water handling and disposal; and backfilling, grading, repaving and site restoration/revegetation.
- The estimated volume of soil to be excavated includes approximately 30,000 cubic yards of contaminated soil. The areal extent that will be disturbed during removal of this soil is approximately 83,000 square feet, or approximately 1.9 acres. Other non-identified tasks may be required to satisfactorily complete the work. This document, estimated soil removal volumes shown in this document, and the attached plan sets are to be used by the Contractor in preparing their bid submittal to achieve the proposed cleanup objectives. Exceptions to the estimated soil volumes should be noted in the bid submittal, but the bid submittal should be based on the quantities listed on the Plans.

The Contractor shall base their initial Bid Submittal on the Draft Plans and Specifications that have been provided by the Engineer. A Final Plans and Specifications package will not be available until after Washington State Department of Ecology (Ecology) review and public comment have been completed on or about June 20, 2008. The Contractor selected for the work will be permitted to adjust their Bid Submittal as necessary to perform the work in compliance with the Ecology-approved Final Plans and Specifications.

The Bid Submittal shall consist of two sections: 1) Technical Qualifications and 2) Cost Form. Contractor shall submit their Bid Submittal as described below:

- Technical Qualifications submitted in response to this invitation must be specific and complete, and demonstrate a thorough understanding and appreciation of the potential technical problems. The submittal must clearly indicate the capability and experience of the Contractor to perform the work.
- All assumptions, quantities, etc., required to prepare the Bid Submittal should be clearly stated in the Cost Form. The Cost Form shall include itemized lump-sum and/or unit rates (see Cost Form, Tables 1 through 4) for each of the tasks identified inclusive of labor, materials and

subcontractors and all applicable state and local taxes. The Contractor shall submit the Cost Form with the Contractor's time-and-materials unit rate sheet applicable to this project for the Engineer's review.

Table 1. Cost Proposal Form – Area A

Cost Proposal Form Remediation Excavation The BNSF Oil Pipeline Site Tacoma, Washington Area A					
Date _____					
Item	Task	Quantity	Units	Unit Cost	Extended
1	Mobilization/Demobilization	1	LS		
2	Site Preparation				
2A	Temporary Facilities and Site Control	1	LS		
2B	Temporary Security Fence	970	LF		
2C	TESC - Silt Fence	400	LF		
2D	TESC - Sand Bags and Wattles	400	LF		
2E	Precast Concrete Traffic Barrier	0	LF		
3	Soil Excavation	9,882	TON		
4	Loading and Coordination of Impacted Materials Disposal	9,882	TON		
5	Temporary Shoring				
5A	Temporary Shoring - to be Removed	0	LF		
5B	Temporary Shoring - to Remain in Place	0	LF		
6	Contaminated Material and Debris - Management and Disposal				
6A	Water Collection and Storage	1	LS		
6B	Disposal of Impacted Water	50,000	GAL		
6C	Disposal of Construction Debris	50	Ton		
7	Excavation Backfilling and Grading				
7A	Imported High TOC Backfill	0	TON		
7B	Imported Bank Run Backfill	7,938	TON		
7C	Imported Ballast	1,053	TON		
7D	Imported Class A Base Course	446	TON		
7E	Imported Class A Top Course	135	TON		
7F	Crushed Gravel Surfacing	311	TON		
7G	Precast Concrete Traffic Curbing	0	LF		
7H	Backfilling	9,882	TON		
7I	Crushed Gravel Surfacing Placement/Grading	12,000	SF		
7J	Replace Portland Cement Sidewalk	0	SF		
7K	Restore Vegetation and/or Landscaping	1	LS		
7K	Asphalt Placement and Grading	10,800	SF		
Construction Cost Subtotal					
Washington State Sales Tax @ 8.8%					
Total (numbers)					
Total (written)					
Contractor Name					
Contractor Authorized Signature					

The Lump Sum and Unit Costs shall include all costs associated with completing the work, including but not limited to mob/demob, labor, overhead, profit, equipment, taxes, materials, supplies and outside services.

Table 2. Cost Proposal Form – Area B

Cost Proposal Form Remediation Excavation The BNSF Oil Pipeline Site Tacoma, Washington Area B					
Date _____					
Item	Task	Quantity	Units	Unit Cost	Extended
1	Mobilization/Demobilization	1	LS		
2	Site Preparation				
2A	Temporary Facilities and Site Control	1	LS		
2B	Temporary Security Fence	700	LF		
2C	TESC - Silt Fence	200	LF		
2D	TESC - Sand Bags and Wattles	300	LF		
2E	Precast Concrete Traffic Barrier	0	LF		
3	Soil Excavation	5,400	TON		
4	Loading and Coordination of Impacted Materials Disposal	5,400	TON		
5	Temporary Shoring				
5A	Temporary Shoring - to be Removed	0	LF		
5B	Temporary Shoring - to remain in Place	0	LF		
6	Contaminated Material and Debris - Management and Disposal				
6A	Water Collection and Storage	1	LS		
6B	Disposal of Impacted Water	30,000	GAL		
6C	Disposal of Construction Debris	175	Ton		
7	Excavation Backfilling and Grading				
7A	Imported High TOC Backfill	88	TON		
7B	Imported Bank Run Backfill	4,354	TON		
7C	Imported Ballast	446	TON		
7D	Imported Class A Base Course	378	TON		
7E	Imported Class A Top Course	135	TON		
7F	Crushed Gravel Surfacing	45	TON		
7G	Precast Concrete Traffic Curbing	276	LF		
7H	Backfilling	5,400	TON		
7I	Crushed Gravel Surfacing Placement and Grading	4,600	SF		
7J	Replace Portland Cement Sidewalk	1,150	SF		
7K	Restore Vegetation and/or Landscaping	1	LS		
7K	Asphalt Placement and Grading	9,000	SF		
Construction Cost Subtotal					
Washington State Sales Tax @ 8.8%					
Total (numbers)					
Total (written)					
Contractor Name					
Contractor Authorized Signature					

The Lump Sum and Unit Costs shall include all costs associated with completing the work, including but not limited to mob/demob, labor, overhead, profit, equipment, taxes, materials, supplies and outside services.

Table 3. Cost Proposal Form – Area C

Cost Proposal Form Remediation Excavation The BNSF Oil Pipeline Site Tacoma, Washington Area C					
Date _____					
Item	Task	Quantity	Units	Unit Cost	Extended
1	Mobilization/Demobilization	1	LS		
2	Site Preparation				
2A	Temporary Facilities and Site Control	1	LS		
2B	Temporary Security Fence	1200	LF		
2C	TESC - Silt Fence	300	LF		
2D	TESC - Sand Bags and Wattles	400	LF		
2E	Precast Concrete Traffic Barrier	150	LF		
3	Soil Excavation	22,545	TON		
4	Loading and Coordination of Impacted Materials Disposal	22,545	TON		
5	Temporary Shoring				
5A	Temporary Shoring - to be Removed	225	LF		
5B	Temporary Shoring - to Remain in Place	435	LF		
6	Contaminated Material and Debris - Management and Disposal				
6A	Water Collection and Storage	1	LS		
6B	Disposal of Impacted Water	50,000	GAL		
6C	Disposal of Construction Debris	720	Ton		
7	Excavation Backfilling and Grading				
7A	Imported High TOC Backfill	1,890	TON		
7B	Imported Bank Run Backfill	15,323	TON		
7C	Imported Ballast	3,281	TON		
7D	Imported Class A Base Course	1,539	TON		
7E	Imported Class A Top Course	513	TON		
7F	Crushed Gravel Surfacing	0	TON		
7G	Precast Concrete Traffic Curbing	276	LF		
7H	Backfilling	22,545	TON		
7I	Crushed Gravel Surfacing Placement and Grading	0	SF		
7J	Replace Portland Cement Sidewalk	1,150	SF		
7K	Restore Vegetation and/or Landscaping	1	LS		
7K	Asphalt Placement and Grading	41,000	SF		
Construction Cost Subtotal					
Washington State Sales Tax @ 8.8%					
Total (numbers)					
Total (written)					
Contractor Name					
Contractor Authorized Signature					

The Lump Sum and Unit Costs shall include all costs associated with completing the work, including but not limited to mob/demob, labor, overhead, profit, equipment, taxes, materials, supplies and outside services.

Table 4. Cost Proposal Form – Area D

Cost Proposal Form Remediation Excavation The BNSF Oil Pipeline Site Tacoma, Washington Area D					
Date _____					
Item	Task	Quantity	Units	Unit Cost	Extended
1	Mobilization/Demobilization	1	LS		
2	Site Preparation				
2A	Temporary Facilities and Site Control	1	LS		
2B	Temporary Security Fence	750	LF		
2C	TESC - Silt Fence	100	LF		
2D	TESC - Sand Bags and Wattles	250	LF		
2E	Precast Concrete Traffic Barrier	100	LF		
3	Soil Excavation	770	TON		
4	Loading and Coordination of Impacted Materials Disposal	770	TON		
5	Temporary Shoring				
5A	Temporary Shoring - to be Removed	0	LF		
5B	Temporary Shoring - to Remain in Place	0	LF		
6	Contaminated Material and Debris - Management and Disposal				
6A	Water Collection and Storage	1	LS		
6B	Disposal of Impacted Water	2,000	GAL		
6C	Disposal of Construction Debris	45	Ton		
7	Excavation Backfilling and Grading				
7A	Imported High TOC Backfill	0	TON		
7B	Imported Bank Run Backfill	594	TON		
7C	Imported Ballast	0	TON		
7D	Imported Class A Base Course	108	TON		
7E	Imported Class A Top Course	41	TON		
7F	Crushed Gravel Surfacing	0	TON		
7G	Precast Concrete Traffic Curbing	0	LF		
7H	Backfilling	770	TON		
7I	Crushed Gravel Surfacing Placement and Grading	0	SF		
7J	Replace Portland Cement Sidewalk	180	SF		
7K	Restore Vegetation and/or Landscaping	1	LS		
7K	Asphalt Placement and Grading	3,300	SF		
Construction Cost Subtotal					
Washington State Sales Tax @ 8.8%					
Total (numbers)					
Total (written)					
Contractor Name					
Contractor Authorized Signature					

The Lump Sum and Unit Costs shall include all costs associated with completing the work, including but not limited to mob/demob, labor, overhead, profit, equipment, taxes, materials, supplies and outside services.

1.2 CONTRACTOR SITE WALK AND COORDINATION MEETING

A coordination meeting followed by a Site walk will be held at 10:00AM PDT on May 21, 2008. Contractors will meet at GeoEngineers' Tacoma, Washington office (1101 South Fawcett Avenue, Suite 200) followed by a Site walk. Contractor attendance at Site walk is mandatory to be considered eligible for contract award. In the event a Contractor is unable to attend on the date listed above, an alternate date can be arranged for a Site visit by contacting GeoEngineers (GeoEngineers, hereafter referred to as the "Engineer").

1.3 BID SUBMITTAL DUE DATE

The Bid Submittal is due on or before May 29, 2008 at 5:00 p.m. at the following address:

GeoEngineers, Inc.
Attn: Sally Fisher
1101 South Fawcett Avenue, Suite 200
Tacoma, Washington 98402

1.4 BID SUBMITTAL FORMAT

Contractors shall address the items described below in the technical section of the Bid Submittal. The Bid Submittal format shall be as follows:

Title Page – This page shall include a list of persons responsible for preparation of the Bid Submittal, the Contractor's general construction and hazardous waste license numbers, and shall be signed by an authorized representative of the Contractor.

Brief Statement of Qualifications – This section shall focus on the specific qualifications of the project office and project personnel who shall be responsible for performing the work.

Project Staff and Subcontractors – This section shall provide an organizational chart listing the project staff and a description of the responsibilities and anticipated level of effort for each staff member. At a minimum, responsible persons shall be identified for the following activities:

- Project Manager
- Construction Field Superintendent(s)
- Site Health and Safety Officer(s)

Resumes of these individuals shall be included in an appendix to the Bid Submittal. The key personnel to this project proposed by the Contractor shall be subject to approval by the Engineer. The key personnel approved by the Engineer shall not be removed or replaced without the Engineer's approval during the entire course of the project.

The Contractor shall provide a list of subcontractors, the scope of their subcontract, and the subcontractor's contractor's license number. This information is not required for routine material or equipment rental suppliers. The Contractor shall submit information about the technical experience of each specialty subcontractor. The Contractor shall provide the company name and facility location for any additional disposal or material receiving facilities associated with the execution of this work.

Scope of Work – Contractor shall explain in detail their approach to complete the proposed services. The proposed scope of work shall be presented by task in the Technical Portion of the Bid Submittal.

Deviations from (or additions to) these tasks are acceptable. However, the scope and rationale for each task shall be clearly explained so an appropriate cost can be derived.

Unexpected Conditions – Contractor will carefully review Plans and Specifications and list any and all activities and associated unit costs for unexpected conditions or activities that might be incurred during this project. If a specific item is not listed in the Cost Form, Contractor shall include activities, costs and assumptions in their Bid Submittal.

Safety Qualification – Contractor shall submit a list of Worker’s Compensation Experience Modification Rate (EMR) (including EMR information for major Subcontractors) and a list of any Occupational Safety and Health Administration (OSHA), Environmental Protection Agency (EPA) or regulatory agency citations for the most recent three years

1.5 PROPOSED CHANGES, EXCEPTIONS AND MODIFICATIONS

Contractors must state in their bid any exceptions, changes, or modifications to any of the documents (including contract terms and conditions) that are part of this solicitation. Any exceptions, changes, or modifications received after the proposal due date may deem your proposal as non-responsive and thus disqualified from consideration for award. The Agreement will be negotiated with the number one-ranked bidder for the project. If agreement is not reached, negotiations will be terminated. Negotiations will then begin with the second choice.

Irregularities – Engineer reserves the right to reject any and all bids or waive any non-material irregularities or information in the Contractor’s proposal.

Confidentiality of Information – All information and data furnished to the Contractor by Engineer and all other documents to which the Contractor’s employees have access during the preparation and submittal of the Contractor shall be treated as confidential. Any oral or written disclosure to unauthorized individuals is strictly prohibited.

Addenda – Engineer may modify the bid request at any time prior to the due date, by issuance of an addendum to all Contractors who are participating in the process at the time the addendum is issued. Addenda will be numbered consecutively.

Clarification – Engineer reserves the right to seek clarification of each bid submitted.

Validity – Bids shall be firm, binding, and irrevocable offers for a period of 60 days following the bid opening.

Proposal Cost – This invitation to bid does not commit Engineer to pay for any costs incurred in the development or submission of your proposal, nor does it commit Engineer to procure or subcontract for any services.

1.6 BID EVALUATION CRITERIA

Engineer reserves the right to reject your proposal should it be evaluated as non-conforming or non-responsive to the requirements of this invitation to bid and to postpone the award.

Bid evaluation will be made according to cost, technical qualifications, health and safety history, and “Overall Best Value” as determined by the Engineer.

1.7 BID COST FORM

The Price shall be itemized in the Bid Submittal using the Bid Cost Form (Table 1, 2, 3 and 4). Assumptions regarding the Bid Cost shall be itemized in detail and attached to the form.

1.8 FINAL BID SUBMITTAL

The Engineer shall provide a copy of the final Engineering Design Report (EDR) to the selected Contractor after receipt of Ecology and public comments. The selected Contractor shall review their Bid Submittal with regard to any changes to the Contractor’s assumptions, approach, or costs, and submit a Revised Bid Submittal to the Engineer. This Revised Bid Submittal shall serve as the basis for the Construction Contract.

1.9 CONSTRUCTION CONTRACT AND GENERAL CONDITIONS

The Contractor will be issued a Work Order for this work in accordance with the terms of the Master Services Remediation Subcontract Agreement between BNSF and Contractor. A copy of a sample contract will be provided during the Site Walk. The contractor will comply with all terms and conditions including insurance, safety, and security conditions.

The contractor must demonstrate their ability to comply with insurance requirements in the General Conditions, including the requirement for Pollution Liability insurance when working at contaminated sites by providing a letter from their insurance carrier or current Certificate of Insurance with their bid.

Bidders shall not make their bids contingent upon Engineer’s acceptance of contract terms that conflict with those herein.

1.10 MEASUREMENT AND PAYMENT

1.10.1 Measurement

In measuring all acceptably completed bid items of work, the Engineer will:

1. Use United States standard measure;
2. Make all measurements as described in this section, unless individual Specifications require otherwise,
3. Follow methods generally recognized as conforming to good engineering practice;
4. Conform to the usual practice of carrying measurements and computations to the proper significant figure or fraction of units for each item; and
5. Measure horizontally or vertically (unless otherwise specified).

The terms listed below shall be defined as follows in all measurements under this section:

- “Lump Sum” (when used as an item of payment): complete payment for the work described for that item in the contract.
- “Gage” (in measurement of plates): The U.S. Standard Gage.

- “Gage” (in the measurement of galvanized sheets used to manufacture corrugated metal pipe, metal plate pipe culverts and arches, and metal cribbing): that specified in American Association of State Highway and Transportation Officials (AASHTO) M 36, M 167, M 196, M 197 or M 219.
- “Gage” (in measurement of wire): that specified in AASHTO M 32.
- “Ton”: 2,000 pounds of avoirdupois weight.
- “Square Yard or Square Foot”: the measurement shall be a calculation from the neat dimensions shown in the Plans or as altered by the Engineer. If there is an exception within the measured area where the item of work is not performed and if the exception area is greater than 9 square feet, then the area of exception will be subtracted from the payment area calculated from the neat dimensions.
- “Linear Foot”: measured parallel to the structure’s base or foundation, unless the Plans require otherwise.
- “Gallon”: measurement shall be in U.S. gallons, as measured by the licensed disposal facility at the time of disposal.

For each item listed below, the Engineer will use the method of measurement described.

- Standard Manufactured Items: measured by the manufacturer’s identification gage, unit weight, section dimension, etc. The Engineer will accept manufacturing tolerances set by each industry unless cited specifications require more stringent tolerances.

No measurement will be made for:

1. Work performed or materials placed outside lines shown in the Plans or set by the Engineer;
2. Materials wasted, used or disposed of in a manner contrary to the contract;
3. Rejected materials (including those rejected after placement if the rejection resulted in the Contractor’s failure to comply with the contract);
4. Hauling and disposing of rejected materials;
5. Material remaining on hand after the work is completed; or
6. Any other work or material contrary to any contract provision.

1.10.2 Payment

Contractor shall submit invoices to Engineer for payment based on the pricing format outlined in the Bid Submittal and in accordance with the requirements of the contract between Engineer and Contractor. The invoices shall clearly show the activities and the quantities for the unit price items for which payment is requested. Field records that will have been approved by the Engineer shall support quantities for the unit price items. Contractor shall be allowed to invoice monthly for serviced performed. The Engineer will pay all undisputed amounts directly to Contractor within 10 days of receipt of payment from Owner or 75 days after receipt of invoice, whichever is earlier, minus 10 percent retention Upon satisfactory completion of the entire project as determined by the Owner and the Engineer and a signed lien release provided by Engineer certifying that there are no unpaid claims which would provide the basis of a lien against the premises, the retention will be paid.

The Contractor will provide means for the Engineer to determine measurement, and therefore payment. This includes means to weigh contaminated and non-contaminated soil and other materials.

1.10.3 Schedule

Work shall be performed in general accordance with the construction schedule specified in the Engineering Design Report (EDR). Construction will be permitted as late as September 30, 2008. The Owner would prefer that all work be completed during the 2008 construction season. In the event that any portion of the work is not completed during the 2008 construction season, construction on the Site will not be allowed to resume until June 15, 2009. All work on the site must be completed by September 30, 2009.

1.11 LIQUIDATED DAMAGES

Failure to complete the project by September 30, 2009 will result in damage to the Owner. Since actual damage will be difficult to determine, it is agreed that the Contractor shall pay, not as a penalty but as liquidated damages, as follows.

Failure to complete the fieldwork by September 30, 2009 shall result in liquidated damages of \$5,000 per day. Liquidated damages will not be assessed for schedule adjustments for conditions beyond the control of the Contractor or extensions by the Owner.

Liquidated damages are cumulative and not mutually exclusive. Liquidated damages under this Section shall be in addition to, and not in lieu of, any other damages, liquidated or otherwise, that may be assessed or payable under this agreement.

1.12 PERFORMANCE/PAYMENT BONDS

Contractor shall furnish performance and payment bonds as follows:

1. The penal amount of performance bonds at the time of contract award shall be 100 percent of the original contract price.
2. The penal amount of payment bonds at the time of contract award shall be 100 percent of the original contract price.
3. Additional bond protection.
 - BNSF may require additional performance and payment bond protection if the contract price is increased. The increase in protection generally will equal 100 percent of the increase in contract price.
 - BNSF may secure the additional protection by directing the **Contractor** to increase the penal amount of the existing bond or to obtain an additional bond.
4. Furnishing executed bonds. The **Contractor** shall furnish all executed bonds, including any necessary reinsurance agreements, to BNSF, within 10 days of final execution of the Agreement by BNSF. Commencement of work is predicated upon approval of the Performance and Payment Bonds.

2.0 CONTACTS/ROLES

The following provides a listing and contact information for parties that will be involved in the remediation program at the Site including the Owner, regulatory agencies and the Engineer. All questions, comments and requests regarding this RFP shall be addressed to the Engineer.

2.1 OWNER

Name: Burlington Northern Railway Company (BNSF)

Contact: Bruce Sheppard

Street Address: 2454 Occidental Avenue South, Suite 1A, Seattle, Washington 98134-1451

Phone No.: (206) 625-6035

Fax No.: (206) 625-6007

E-Mail: bruce.sheppard@bnsf.com

2.2 ENGINEER

Name: GeoEngineers, Inc.

Contacts: Sally Fisher – Project Manager

 Tony Mathis – Project Engineer

 John Biggane – Principal

Street Address: 1101 South Fawcett Avenue, Suite 200, Tacoma, Washington 98402

Phone No.: (253) 383-4940

Fax No.: (253) 383-4923

E-mail: sfisher@geoengineers.com

tmathis@geoengineers.com

jbiggane@geoengineers.com

2.3 WASHINGTON STATE DEPARTMENT OF ECOLOGY

Name: Washington State Department of Ecology (Ecology)

Contact: Marv Coleman, Site Manager, Toxics Cleanup Program

Street Address: 4601 North Monroe Street, Spokane, Washington 99205-1295

Phone No.: (360) 407-6300

Fax No.: (360) 407-6305

E-mail: mcol461@ecy.wa.gov

3.0 REFERENCES

All work under the Contract shall be done in accordance with this document and, insofar as they may apply, the most current edition of the following codes, specifications, standards and guides, and others as specified elsewhere in the document.

- American Conference of Governmental Industrial Hygienists (ACGIH)
- American Public Works Association (APWA)
- American Society for Testing and Materials (ASTM)
- Environmental Protection Agency (EPA)
- Hazardous Waste Operations (HAZWOPER)
- Model Toxics Control Act (MTCA)
- National Institute of Occupational Safety and Health (NIOSH)
- Occupational Safety and Health Administration (OSHA)
- Washington Administrative Code (WAC)
- Washington Industrial Safety and Health Act (WISHA)
- Washington State Department of Transportation (WSDOT)

4.0 COORDINATION OF OPERATIONS

The Contractor shall conduct their operations in a manner that causes the least possible obstruction and inconvenience to any activities of the surrounding businesses. At its sole expense, the Contractor shall furnish, erect, and maintain temporary fences, vehicular barricades, signs, lights, and cones as may be necessary to provide access to abutting streets and to warn the public and on-site personnel of work in progress. Coordination of all traffic and traffic control devices shall be in accordance with the current BNSF, WSDOT and the City of Tacoma standards. The Contractor shall coordinate all activities with other Contractors in the area when necessary.

All personnel working on BNSF projects are required to wear identification badges at all times that includes a current photograph, the person's name, title, and company, and contact information. Identification badges shall be prominently displayed.

5.0 REGULATIONS AND PERMITS

This Remedial Action is being implemented in accordance with WAC 173-340-400 Implementation of the Cleanup Action. This chapter is a part of WAC 173-340, also known as the MTCA Cleanup Regulations. Relevant regulations for the Site include:

Health and Safety: WAC 296-155 (Safety Standards for Construction) and 29 CFR 1910.120 specify health and safety standards at hazardous waste sites.

Stormwater Management: A Construction Stormwater Pollution Prevention Plan (SWPPP) will be prepared by the Engineer, after receipt of Ecology and public comments on the Draft EDR. A copy of the SWPPP will remain on Site during construction activities and shall be readily accessible by the Contractor, the Engineer, the Owner, and to regulatory agencies upon request. The Contractor shall be

required to implement the SWPPP and include all costs associated with such implementation in their Bid Submittal.

Waste Characterization: Waste generated during the remediation will be characterized for disposal by the Engineer in general accordance with WAC 173-303. The Contractor will not be responsible for costs related to waste characterization.

Hauling of Hazardous Waste: WAC 173-303-240 through WAC 173-303-270 specify the requirements for transportation of hazardous waste. WAC 173-303-190 specifies requirements for preparing hazardous waste for transport. The Contractor will be responsible for complying with these requirements if hazardous waste is to be transported off of the Site.

Solid Waste Management: WAC 173-304 specifies requirements for the proper handling of all solid waste materials. The Contractor will be responsible for complying with these requirements when solid waste is to be transported off of the Site.

Grading Permit: The Engineer shall complete a grading permit application and submit it to the City of Tacoma for review and acceptance.

Street Use Permit: The Engineer shall complete a permit application and submit it to the City of Tacoma for review and acceptance.

Special Approved Discharge permit (for disposal of excavation dewatering water into the sanitary sewer system): In accordance with the City of Tacoma, the Contractor shall complete a permit application and submit it to the City of Tacoma for review and acceptance. The Contractor shall obtain all the approvals required and provide written approvals to the Engineer after the Engineer supplies the necessary data.

Waste Disposal Authorization: The Engineer shall complete the required forms and submit it to the Tacoma-Pierce County Health Department (TPCHD) for review and acceptance.

Noise Control: Construction activities at the Site will be performed so that noise emissions from construction are in general conformance with Pierce County Code 8.76.060. The activities at the Site are “temporary construction activities” as described in Pierce County Code 8.76.060.C.1, and noise emissions are limited only during the hours of 07:00 to 22:00. Accordingly, construction activities will only be permitted between the hours of 07:00 to 22:00.

6.0 UTILITIES

The Contractor shall be responsible for providing water supply services to the Site for the scope of work specified in this document. A portable water supply will be acceptable for the purposes of this contract, providing all applicable health and safety standards are met.

The Contractor shall be responsible for marking and protecting all existing Site utilities and groundwater monitoring wells. Service interruptions shall not be permitted.

7.0 SAFETY

The Contractor shall be solely and completely responsible for Project Site conditions and safety during the term of the Contract. This obligation shall include the safety of all persons within or affected by the line of construction and all private property affected by the work.

The Contractor shall prepare a site-specific Health and Safety Plan (HASP) for review by the Engineer prior to initiating the work as specified in Section 9.0 "Site Work" of this document.

The Contractor shall be fully responsible to comply with all federal OSHA regulations that apply to this Contract.

The Contractor shall be fully responsible to comply with all BNSF rules, policies and regulations that apply to this Contract.

The Contractor's responsibility shall be continuous and not limited to working hours or days, and shall not cease until Engineer/Owner fully accepts the work. If Engineer/Owner partially accepts the work, the Contractor's responsibility for the portion of the work so accepted shall thereupon cease except for latent errors in the work or for faulty construction.

The Contractor shall be responsible for posting signs that comply with federal, state and local agencies rules and requirements.

The Contractor shall give a "clear and reasonable warning" to its employees and the general public for any workplace or environmental exposure which results from its activities during the course of this project.

The Contractor shall be responsible for furnishing, erecting, and maintaining fences, barriers, lights and signs as necessary for physical security, public safety and safety of its workers. The Contractor shall secure the fencing at the end of each working day.

The Contractor shall store fuel, water and equipment required for the work within the designated Support Zone or in the active construction areas approved by the Engineer.

Required submittals relating to health and safety are described in Section 101.0 "Submittals" of this Bid Request.

8.0 PROJECT SUPERVISION

8.1 CONTRACTOR'S SUPERVISION

The Contractor shall provide the services of a full-time, experienced and qualified construction field superintendent who shall be assigned to the job during the course of the work.

The person designated as construction field superintendent shall have direct charge of the work and shall be authorized to accept and execute all orders and directions issued by the Engineer. The construction field superintendent shall be readily available during normal work hours for consultation with the Engineer and be physically on the job Site during Site activities. The construction field superintendent shall not be removed or replaced during the entire course of the contract work without the written approval of the Engineer.

8.2 JOB SITE ADMINISTRATION

The Engineer will represent the Owner on the Site.

9.0 SITE WORK

All Site work described in this contract shall be completed by 40-hour HAZWOPER trained personnel. Supervision of personnel at the site shall be performed by individuals that have received appropriate Hazardous Waste Site Supervisors training.

9.1 MOBILIZATION AND DEMOBILIZATION

Mobilization consists of providing all construction equipment, materials and supplies, temporary facilities, and electrical and fresh water supplies at the site to complete the contract work. Demobilization includes removing all equipment, remaining materials and supplies, and all temporary facilities, and cleanup of the Site at the completion of this contract work as provided in these Specifications.

“Mobilization and Demobilization” (Bid Item 1) shall be measured as a unit, and paid for at the contract lump-sum (LS) price. Fifty percent of the Mobilization and Demobilization shall be paid upon completion of mobilization and 50 percent upon demobilization.

9.2 SITE PREPARATION

The Contractor shall complete the following activities before performing any excavation actions:

- Installation of temporary facilities and controls.
- Installation of temporary erosion and sedimentation controls (TESC).
- Clearing site of vegetation.
- Saw cutting and removal of pavement within the excavation area.

Descriptions of specific tasks relating to these activities are provided below.

9.2.1 Temporary Facilities and Site Controls

The Contractor shall supply all materials, equipment and labor necessary to install the temporary facilities and controls at the general locations indicated in the Plans. The Contractor shall:

1. Provide, maintain and pay for suitable quantity of water service for the activities related to the contract work. Provide potable water and portable restrooms within the designated Support Zone. Provide, maintain and pay for suitable quantity of water service for the activities related to the contract work. Contractor shall attain applicable permits to provide potable water and portable restrooms within the designated Support Zone.
2. Provide and maintain in clean, good working order, an emergency decontamination and eye wash station.
3. Provide portable units for sanitary waste that shall be regularly collected by a licensed sanitary waste management contractor and disposed of in an appropriate manner.
4. Provide all power for heating, lighting, operation of Contractor’s office or equipment, or for any other use by the Contractor at the Contractor’s expense. Temporary heating and lighting shall be maintained until the work is completed.
5. Maintain a suitable office at the Site. Contractor shall also provide a minimum 100-square-foot working space within the Site office for the Engineer. The Contractor shall allow access to the Engineer all facilities available in the office. Copies of Plans, Specifications and other contract

documents shall be kept on Site during the course of work and be made available for use at all times.

6. Make all necessary arrangements and pay all installation and operation charges for telephone lines connected to offices on Site and shall provide all telephone instruments.
7. Establish a Support Zone, Exclusion Zone and Decontamination Zone as generally indicated on the Plans.
8. Lay out the work zones and establish boundaries, barriers, facilities and controls as indicated on the Plans, to ensure that all personnel and equipment exiting the Exclusion Zone shall pass through the Decontamination Zone before entering the Support Zone and before exiting the Site.
9. Prepare a decontamination pad in the Decontamination Zone on Site within the Exclusion Zone for vehicle and personnel decontamination. The Contractor shall provide facilities to decontaminate all vehicles, equipment and personnel prior to leaving the Exclusion Zone.
10. Be responsible for maintaining construction equipment and machinery on Site and ensuring that equipment is in proper working order. The Contractor shall inspect equipment and machinery for leaks prior to mobilization on Site.
11. Establish a Support Zone for storage, sanitary facilities, hand washing facilities and non-construction vehicles parking.
12. Provide a drainage and collection system for wastewater generated during decontamination procedures as generally shown on the Plans. The wastewater shall be transferred to on-site storage tanks provided by the Contractor. The water collection system shall be approved by the Engineer prior to collection.
13. Prevent tracking of soil or contaminants onto any public right-of-way during all contract work. During the construction activities, Contractor shall be responsible for all costs associated with removal and/or cleanup of contaminated materials located outside of the Contractor Limits of Work and any damage that may have been caused by the materials.
14. Schedule and conduct hauling operations to the on-site containment area as presented in Section 9.5. Contractor shall use the construction entrance shown on the Plans for ingress/egress to the Site during Site work.
15. Provide written notification to the public a minimum of 24 hours, and a maximum of 72 hours, in advance of blocking parking/public access at any of the project locations. The notices shall provide a brief explanation of the scope of work and the name and phone number of a Contractor contact person. The Contractor shall provide barricades, cones, etc. as required for parking/public access closures following distribution of notices.
16. Furnish all required signage as well as any other appropriate signs requested by the Engineer warning the public of construction activities on Site. The Contractor shall provide the posts or supports and erect and maintain the signs in a clean, neat and presentable condition until the necessity for them has ceased.
17. The Contractor shall install temporary chain link site fencing around the Site and to lines as generally shown and detailed in the Plans. The Contractor shall furnish and post signs at a spacing no greater than 100 feet warning the general public that the Site contains physical and chemical hazards and that the access is forbidden to unauthorized persons. Contractor shall remove the temporary fencing upon completion of the contract work.

18. Install two 16-foot-wide chain link double swing gates to provide a 32-foot opening at a location as generally shown on the Plans and provide chains for locking the gates. The Engineer and the Contractor will each provide their own locks for the gates. Typical construction details are provided on the Plans.

Temporary facilities and controls shall include the labor, equipment and materials required to complete the work described in this section. The item will be measured as a lump-sum unit. Note that the temporary security fence shall be a separate item, which will be measured and paid for by actual lineal feet installed for the entire duration of this contract work. The Contractor shall assume a total of three months for the use of temporary fencing. Contractor shall remove the temporary fencing upon either placement of the final asphalt surfacing at the remedial area, or in the case of construction at the WSDOT pond area, upon acceptance of the remediated area by WSDOT before reconstruction of the stormwater ponds.

9.2.2 Temporary Erosion and Sedimentation Controls (TESC)

The Contractor shall install TESC at the general locations indicated on the Plans. The Contractor shall:

1. Install silt fence or other approved erosion controls at the locations indicated on the Plans. Construct erosion control in accordance with the typical details shown on the Plans and Specifications and/or as indicated in the Stormwater Pollution Prevention Plan (SWPPP). Silt fence, sand bags, straw wattles other equivalent materials approved by the Engineer and/or as described in the SWPP shall be placed on the down slope sides of the work areas and Contractor ingress/egress points as shown on the Plans.
2. Install and maintain silt fence conforming to the specifications set forth by BMP C233 from the *Stormwater Management Manual for Western Washington, Chapter 4-Standards and Specifications for Best Management Practices, WDOE, February 2005*. The Contractor shall install and maintain temporary silt fences at the locations shown on the Plans. The silt fences shall be installed in areas of clearing, excavation and grading prior to commencing work. The filter fabric will have an AOS (ASTM D 4751) equal to a 30 – 100 sieve size and 50 – 100 sieve size for all other fabrics. The fabric shall have a 70 percent minimum ultraviolet resistance (ASTM D 4355) and a minimum permittivity (ASTM D 4491) of 0.02 sec^{-1} . Maximum grab tensile strength (ASTM D 4632) shall be 30 percent (180 pounds minimum for extra strength fabric and 100 pounds minimum for standard strength fabric). The minimum height of the top of silt fence shall be 2 feet and the maximum height shall be 2.5 feet above ground surface. The geotextile shall be sewn together at the point of manufacture or overlapped so that the overlap is long enough to prevent silt-laden water from escaping through the fence at the overlap. The fabric shall be attached at the up-slope side of the posts with staples, wire or in accordance with the manufacturer's specifications. Wire backup support shall be used with a maximum spacing of 2 inches. The strength of the wire shall be equivalent to or greater than 180 pounds grab tensile strength. The fence posts shall be placed or driven a minimum of 18 inches bgs. Wood, steel or equivalent posts shall be used. Wood posts shall have minimum dimensions of 2 inches by 2 inches by 3 feet minimum length and shall be free of defects. Steel posts shall consist of either size No. 6 rebar or larger or ASTM A 120 steel pipe with a minimum diameter of 1 inch. Fence posts shall be installed on 8-foot centers or as specified by the Engineer. The Contractor shall repair any damage to the silt fence immediately after discovery.
3. The silt fence shall be relocated as specified by the Engineer if concentrated flows are present in areas where erosion control was not previously placed. Sediment deposits shall be removed when

the deposit reaches 6 inches above ground surface on the upgradient side of the fence. See Plan Sheet D-1 for silt fence details.

4. Dust control techniques will be implemented for construction activities that could generate dust. Dust control can include but is not limited to:
 - Clearing only those areas where immediate activity will take place while maintaining original ground cover as long as practical.
 - Spraying exposed surfaces with water and repeating as necessary throughout the course of construction. Water applied as dust control shall not leave the Site as surface runoff.
 - Dust control techniques must be approved by the Engineer prior to application. Routine maintenance of chosen dust control technique is necessary to keep dust to a minimum. Contractor shall coordinate use of possible water sources from public or private sources to provide dust control throughout the contract work. The Contractor is responsible for a use permit and associated expenses, as required. Dust control for the project will include all labor, equipment and materials required to complete the work described in this section. The item will be paid for on a lump-sum basis.
5. Maintain temporary construction equipment access roadways as generally shown on the Plans. The Contractor shall implement control measures to limit disturbing existing ground surfaces in this area.
6. Streets will be kept clean of construction debris and mud associated with construction vehicles and equipment. Any sediment that is tracked onto pavement shall be removed by shoveling or street sweeping. The sediment removed by sweeping shall be removed or stabilized on Site. The pavement shall not be cleaned by washing down the street, except when sweeping is ineffective. Runoff from street washing must be controlled and stabilized on Site. If the entrance and exit to the Site is tracking sediment onto pavement areas, then alternative measures to keep the streets free of sediment must be implemented.
7. Maintain tire cleaning in accordance with BMP C105: *Stabilized Construction Entrance (Stormwater Management Manual for Western Washington, Chapter 4-Standards and Specifications for Best Management Practices, WDOE, February 2005)*. Construction entrance and exit shall be constructed to prevent sediment tracking onto public streets. The surface material shall be 4 inches to 8 inches quarry spalls over a separation geotextile fabric. The geotextile must have a minimum grab tensile strength of 200 psi, maximum grab tensile elongation of 30 percent, 400 psi minimum Mullen Burst Strength, and conform to a 20 – 45 U.S. standard sieve size per ASTM Standards D 4751, D 4632 and D 3786-80a. If the stabilized construction entrance/exit proves ineffective in controlling the migration of hazardous constituents off site, then BMP C 106: *Wheel Wash (Stormwater Management Manual for Western Washington, Chapter 4-Standards and Specifications for Best Management Practices, WDOE, February 2005)*, or equivalent will be used in conjunction.
8. Install stormwater controls, such as berms or swales, as needed, within the limits of work area to avoid any stormwater runoff discharge and to avoid any stormwater run-on into the work area. Stormwater controls shall be approved by the Engineer prior to placement.
9. Contain decontamination water, and stormwater runoff in excess of natural infiltration within the Exclusion Zone. The decontamination water and excess stormwater runoff shall be collected and stored in on-site water storage tanks and transported off Site for disposal at a facility licensed to appropriately dispose of the water or used for dust suppression purposes on Site. The tanks shall be equipped with readily accessible sampling ports for the Engineer to collect water samples.

The Contractor shall be responsible for sampling and adequately characterizing the water to meet the acceptance requirements and for disposal at an appropriate and licensed facility. Water testing information and anticipated disposal method for the water shall be submitted to the Engineer prior to the water disposal.

10. TESC – silt fence, TESC – sand bags, and TESC – hay bales shall include the labor, equipment and materials associated with their installation, including inspection, maintenance and removal at project completion. Each of the three items will be measured and paid for on the basis of actual lineal feet of silt fence/sand bags/hay bales installed.
11. No separate measurement and payment will be made for work to install other stormwater controls as required and not shown on the Plans, as directed by the Engineer for erosion and sediment control, if necessary. The cost for this portion of work shall be considered incidental and included in the unit price.

9.2.3 Standard Specifications

All work shall be performed in accordance with the following specifications except as may be exempted or modified by these contract documents. These specifications are included by reference, made a part of this Sub-Section and shall control and guide activities where referred to directly, paragraph by paragraph.

WSDOT/APWA “2006 Standard Specifications for Road, Bridge and Municipal Construction” as amended by the APWA Supplements, hereinafter referred to as the “Standard Specifications”.

In conjunction to these standard specifications the following other specifications and standard plans shall apply to the extent to which they are called out in these Plans and Specifications.

1. Any other requirements or permits as identified by the City of Tacoma.
2. “Standard Plans for Road and Bridge Construction” as prepared by WSDOT, hereinafter referred to as the “WSDOT Standard Plans.”

9.2.4 Saw Cutting and Removal of Pavement

Removal of pavement shall include saw cutting, control of cutting operations, and management of slurry and cuttings in accordance with BMP C152 of the Western Washington Stormwater manual, removal of asphaltic and/or Portland cement pavement, and disposal of asphaltic concrete and/or Portland cement pavement as shown on the Plans, or as directed by the Engineer. This item shall include all equipment, materials, and labor furnished to complete the work described in this Section. This item will be measured and paid for by measuring the square footage of pavement actually removed, as measured by the Engineer.

9.2.5 Water Supplied from Hydrants

The Contractor shall secure permission from and comply with all requirements of the water utility before obtaining water from fire hydrants. The Contractor shall notify the Engineer as soon as permission has been granted.

The Contractor shall use hydrant wrenches only to open hydrants. The hydrant valve must be open full, since a partially opened valve causes damage. A metered hydrant connection furnished by the water utility shall be used as an auxiliary valve on the outlet line for control purposes. Fire hydrant valves must be closed slowly to avoid a surge in the system, which creates undue pressure on water lines. The Contractor shall carefully note the importance of following these directions.

If a hydrant is damaged, the Contractor shall immediately notify the water utility so that the damage can be repaired as quickly as possible.

Upon completing the use of the hydrants, the Contractor shall notify the water utility so that the hydrants may be inspected for possible damage.

The Contractor shall repair any damage resulting from the use of the hydrants by the Contractor, to the satisfaction of the water utility. The Contractor shall furnish all equipment and tools, except the metered hydrant connection, that may be necessary to meet the requirements of the water distribution agency pertaining to hydrant use.

Any violation of these requirements may result in fines and damage costs resulting from the malfunctioning of damaged fire hydrants, in the event of fire.

The Contractor shall convey the water from the nearest convenient hydrant or other source at his own expense.

9.3 STRUCTURAL SHORING

Structural shoring shall be installed prior to excavation by the Contractor at the general locations shown on the Plans. Structural shoring shall provide lateral support of soils and limit lateral movement of soils supporting structures, roadways, utilities, railroads, etc., such that these items are not damaged as a result of the lateral movement of the supporting soils. Structural shoring systems may include but are not limited to driven cantilever sheet piles, sheet piles with tiebacks, cantilever soldier piles with lagging, or soldier piles with lagging and tiebacks.

Trench boxes, sliding trench shields, jacked shores, shoring systems that are installed after excavation, and soldier pile, sheet pile, or similar shoring walls installed in front of a pre-excavated slope, are not allowed as structural shoring.

Submittals and Design Requirements. The Contractor shall submit Working Drawings and Calculations showing the proposed methods and construction details of structural shoring in accordance with Sections 6-01.9 and 6-02.3(16) of the WSDOT Standard Specifications. The Contractor shall not begin construction of structural shoring, nor begin excavation operations, until approval of the structural shoring submittal has been given by the Engineer. Structural shoring shall be designed for conditions stated in this section using methods shown in Division I Section 5 of the AASHTO Standard Specifications for Highway Bridges Seventeenth Edition – 2002 for allowable stress design, or the AASHTO LRFD Bridge Design Specifications, Third Edition, 2004 and current interims for load and resistance factor design. The USS Steel Sheet Piling Design Manuals, published by United States Steel, may be used for shoring walls that do not support other Structures and that are 15 feet in height or less. Allowable stresses for materials shall not exceed stresses and conditions allowed by Section 6-02.3(17)B. The shoring design shall also be in compliance with the WSDOT Geotechnical Design Manual (M46-03). In the case of conflict or discrepancy between manuals, the Geotechnical Design Manual shall govern. For open temporary cuts associated with a shoring system, the requirements for open temporary cuts specified in Section 2-09.3(3)B of the WSDOT Standard Specifications shall be met. The structural shoring system shall be designed for site specific conditions which shall be shown and described in the Working Drawings. The structural shoring system design shall include the design of the slopes for stability above and below the shoring system.

Installation of structural shoring shall include all equipment, materials and labor furnished to satisfactorily complete the work described in this section. This item will be measured and paid for by measuring at the ground surface the linear footage of shoring installed at the Site. Separate payment will be made for locations where shoring is removed after construction and for locations where shoring remains after construction.

9.4 EXCAVATION OF CONTAMINATED AND UNCONTAMINATED MATERIALS

The Contractor shall excavate the impacted materials from the areas indicated on the Plans. The Contractor shall:

1. Stake or paint excavation boundaries indicated on the Plans prior to excavation. Protect and preserve the survey stakes during the course of work.
2. Allow the Engineer access to excavation areas and perform surveying if deemed necessary by the Engineer.
3. Be solely responsible for excavation slope stability. Excavation work shall be in compliance with applicable OSHA regulations and in accordance with the Contractor's HASP.
4. Control dust emissions and odors during excavation activities in accordance with the Contractor's HASP.
5. Perform excavation in a manner that does not disturb or damage existing structures, utilities, monitoring wells, or other facilities not indicated to be removed, unless the removal of such items is shown on the Plans. Damaged facilities shall be repaired or replaced at the Contractor's expense as determined by the Engineer.
6. Prevent cross-contamination and re-contamination of cleaned areas. At the Engineer's direction, Contractor shall excavate any cross-contaminated material at Contractor's expense.
7. The Contractor shall provide all materials, labor, and equipment necessary to shore trenches to protect the work, existing property, utilities, pavement, etc., and to provide safe working conditions in the excavation as per WSDOT Standard Specification 7-08.3(1)B. The Contractor may elect to use any combination of shoring and overbreak, tunneling, boring, sliding trench shield, or other method of accomplishing the work consistent with applicable local, State, or Federal safety codes. Shoring to be removed, or moveable trench shields or boxes, shall be located at a minimum of two and one half pipe diameters away from metal or thermoplastic pipe if the bottom of the shoring, shield or box extends below the top of pipe, unless a satisfactory means of reconsolidating the bedding or side support material disturbed by shoring removal can be demonstrated. Damages resulting from improper shoring or failure to shore shall be the sole responsibility of the Contractor.
8. The Contractor shall support all existing utilities during excavation activities as to not cause damage resulting in pipe failure or unsafe working conditions per utility owners approved plan.
9. Abandoned utilities shall be removed and disposed of within the limits of the excavation if they are encountered during excavation activities. Where designated by the Engineer, the abandoned utility shall be plugged on the inlet and outlet ends for a distance of two diameters with commercial concrete. Care shall be used in placing the concrete in the utility to see that the opening is completely filled and thoroughly plugged.

10. Wells located within the excavation areas shall be abandoned under the supervision of a driller licensed in the State of Washington in general accordance with procedures described in WAC 173-160. The Contractor shall notify the Engineer at least 1 day in advance of well abandonment.
11. Excavate impacted materials at the locations within the horizontal and vertical limits indicated on the Plans, with allowances for additional areas required for the sloping back of excavation walls to meet OSHA requirements.
12. Allow and provide safe access to the Engineer for observation and collection of samples during the excavation work. Assist the Engineer in collecting samples from the sidewalls and base of excavation areas during the excavation whenever the site conditions are not readily accessible for such sampling activities. If visual observation and field screening indicate the presence of contamination the Contractor shall perform additional excavation at the direction of the Engineer. The Contractor shall not backfill the completed excavation areas until the area has been cleared by the Engineer for backfill. Sampling and analysis will be performed by the Engineer.
13. Excavate additional impacted materials beyond the horizontal and/or vertical limits in the Plans, if there are visual and/or field screening results that indicate soils at the limits of excavation exceed the remedial excavation goals. Contractor shall perform this additional excavation only as directed by the Engineer.
14. Soil stockpiles will be bermed and tarped or otherwise managed by the Contractor to prevent contaminated soil from being mobilized off the site by wind or in precipitation runoff. Berming and tarping of the stockpiles shall be considered as a subsidiary obligation of the Contractor. No separate measurement and payment shall be made for berming, tarping or other management of the stockpile areas.
15. Survey the topographic elevations of the completed excavations once the confirmation sampling results have been approved and prior to being backfilled. The Contractor shall retain a professional surveyor licensed in the State of Washington to perform such surveying and provide a topographic survey map to the Engineer. The surveying data shall be supplied to the Engineer in both electronic (AUTOCAD 2002 or older version) and paper printout formats.

Excavation of impacted materials shall include all equipment, materials and labor furnished to complete the work described in this Section. Protection of and work around existing utilities is considered to be part of this work. This item will be measured and paid for by measuring the excavation cavity in bank cubic yards as determined by the Contractor's survey submitted to the Engineer and comparing the final survey with the existing topography.

9.5 LOADING AND COORDINATION OF IMPACTED MATERIALS DISPOSAL

Soil samples will be collected prior to excavation activities or from stockpiled soil during excavation activities. Representative soil the material above the groundwater table within the limits of each excavation area prior to excavation activities. The Engineer will review the laboratory testing results and provide required waste profiling data to the receiving landfill facility for approval. The landfill facility will be selected and contracted by the Client prior to the commencement of the project. The Contractor shall:

1. Remove the dry material above the groundwater table and directly haul it to the selected landfill facility, after the material has been characterized for disposal by the Engineer.
2. Remove the wet material below the groundwater table following waste characterization sampling by the Engineer and directly haul it to the selected landfill facility.

3. If necessary, stockpile soil Stockpile soil on the LRI lot adjacent to Area A if need be, pending waste characterization laboratory results. Load and haul material to selected landfill facility as directed by the Engineer.
4. Prevent cross-contamination of backfill materials and release of contaminated material outside of the exclusion zone using methods approved by the Engineer.
5. Be responsible for coordination associated with off-site transportation and disposal.
6. Contact the appropriate waste facilities listed below to arrange hauling of the waste materials for off-site disposal.

Loading and coordination of impacted material disposal shall include labor, equipment and materials furnished to complete the work described in this Section. The item will be measured and paid for on the basis of tonnage, as determined by load weight tickets from commercial scales in conjunction with waste manifests. This item will be the same whether the waste is characterized hazardous or non-hazardous.

9.6 BACKFILLING AND GRADING

Once all impacted soil and debris materials are removed, sampling of the excavation sidewalls will be performed by the Engineer. The sampling will proceed as the excavation is in progress. The Contractor shall not backfill the excavation without the Engineer's approval. The backfill materials shall include imported clean soil materials. The Contractor shall:

1. Place backfill material into an excavation only after receiving the Engineer's approval. If the Contractor places the backfill without the Engineer's approval the Contractor shall remove the backfill material from that excavation and dispose of off-site at the Contractor's expense. The backfill material shall be a granular, readily compactable material.
2. Place the backfill materials in maximum loose lifts of 1 foot and compact to at least 95 percent maximum dry density as determined by ASTM D 1557. The Engineer will observe backfill operations so that the backfill meets the requirements in these specifications. Field density testing shall be completed by the Engineer, and at a frequency determined by the Engineer. The Engineer shall perform grain size distribution (ASTM D 422) and modified Proctor (ASTM D 1557) tests on the proposed backfill material. In addition, the Contractor shall complete chemical testing on the imported backfill material for U.S. EPA Priority Pollutants to demonstrate that the backfill is free from contamination. Chemical testing on imported fill shall be performed on the material prior to importing and at the rate of one test every 5,000 tons. All chemical tests shall be supplied to the Engineer for approval.
3. Ballast material shall be placed in areas excavated below the groundwater table and/or in areas not suitable for structural fill placement as determined by the Engineer. Ballast shall be placed 1 foot above the working groundwater table at time of material placement, as indicated on the Plans and as determined by the Engineer. Ballast placement along the eastern excavation sidewall shall be placed up to 2 feet below the groundwater table as indicated on the Plans. Ballast material shall consist of crushed, partially crushed or naturally occurring granular material in accordance WSDOT Standard Specification 9-03.9(1).
4. Backfill material with a high (between 1.5 to 3 percent) Total Organic Carbon (TOC) content shall be placed from 2 feet below the groundwater table to 6 feet below existing grade as shown on the plans along the eastern excavation sidewall. High TOC backfill material shall consist of material free of various types of wood waste or other extraneous or objectionable materials. It may consist of imported soil meeting the TOC contents described in this Section, dredge spoils,

or imported soils that have been amended with activated carbon to be between 1.5 and 3 percent activated carbon by weight. One hundred percent of the material shall pass a 2-1/2-inch opening. High TOC backfill shall have 12 to 15 percent fines passing a U.S. No. 200 standard sieve.

5. Backfill material used for bedding existing water, sewer and natural gas lines shall be select granular material free from wood waste, organic material, and other extraneous or objectionable materials and shall have a maximum dimension of 1-1/2 inches. Material shall be placed to a minimum depth of 6 inches under the pipe and 6 inches over the top of the pipe. The bedding material shall be rammed and tamped around the pipe to 95 percent of maximum dry density as determined by ASTM D 1557 by approved hand-held tools, so as to provide firm and uniform support for the full length of the pipe, valves, and fittings. Care shall be taken to prevent any damage to the pipes or their protective coatings. Backfill above the pipe zone as indicated on the plans shall be accomplished in such a manner that the pipe will not be shifted out of position nor damaged by impact or overloading. Backfill above the pipe zone shall be placed in horizontal layers no more than 6 inches thick and be compacted to 95 percent maximum dry density as determined by ASTM D 1557. The Contractor shall not operate tractors or other heavy equipment over the top of the pipe until the backfill has reached a height of 2 feet above the top of pipe.
6. Backfill material from 11-1/2 inches below existing grade to 2 feet above the groundwater table shall be bank run gravel having 100 percent of the material passing a 2-1/2-inch opening, a 72 minimum stabilometer "R" value and a maximum swell pressure of 0.3 pounds per square inch (psi). The material shall be free of various types of wood waste or other extraneous or objectionable materials. Backfill shall not have greater than 10 percent by weight passing a U.S. No. 200 standard sieve. Bank run gravel shall not be directly placed along the eastern excavation sidewall from 2 feet above the groundwater table to 6 feet below existing grade.
7. Roadway pavement sections shall conform to City specifications, and be 3 inches of asphalt over a minimum thickness of 1-1/2 inches of 3/8 inch minus top course over a minimum thickness of 7 inches of 1-1/4 inch minus base course. Top course and base course materials shall meet WSDOT Standard Specification 9-03.9(3) for crushed surfacing.
8. The finished surface for general site grading shall be within a tolerance of 0.1 feet above or below the elevations as shown on the Plans.
9. Three-inch pavement section shall be hot mix asphalt HMA CL 1/2 inch PG 6422. Mix design shall be based on this 3-inch pavement section and 3 million Equivalent Single Axle Loads (ESALs). Hot mix asphalt shall be compacted to 92 percent of the maximum density as determined by AASHTO T 209. All hot mix asphalt utilized shall be considered compactable. The level of compaction attained will be determined as the average of not less than five nuclear density gauge tests taken on the day the mix is placed at randomly selected locations within each lot as determined by the Engineer. The quantity represented by each lot will be no greater than a single day's production or approximately 400 tons, whichever is less.
10. Precast concrete traffic curbs shall be placed to match existing line and grade at the locations shown on the Plans. The curb shall be firmly bedded for its entire length and breadth on a mortar bed composed of one part Portland cement and two parts of concrete sand. The anchor grooves in the bottom of the curb shall be entirely filled with mortar. All joints between adjacent pieces of curb except joints for expansion and/or drainage as designated by the Engineer shall be filled with mortar composed of one part Portland cement and two parts sand.
11. Perform surveying to record the final surface elevation of completed backfilling and grading. Measure on a 20-foot maximum grid pattern. Provide as-built topographic survey map with a

1-foot contour interval to the Engineer for review and approval. Survey map shall be prepared by a Washington State licensed professional surveyor retained by the Contractor.

Imported backfill materials shall include delivery and handling of the imported backfill materials. This item will be measured on the basis of tonnage of imported backfill materials used for backfilling. Costs associated with shipping, unloading and stockpiling of the imported backfill materials shall be included in this item.

Backfilling and grading shall include the equipment and labor furnished to perform the work described in this Section. This item will be measured and paid for by tonnage of backfill materials placed, compacted and graded to final grading elevations as indicated on the Plans. The quantity of backfill will be determined based on the Contractor-submitted survey of excavation area.

9.7 IMPACTED WATER COLLECTION AND DISPOSAL

All on-site contaminated water that impedes the Contractor operation shall be collected, stored and transported off site for disposal or handled on site for discharge to nearby sanitary sewer. The sources of impacted water include, but are not limited to: surface water/rainfall that may come in contact with contaminated stockpiled material or surface water/rainfall that may enter active excavation areas, and decontamination water. The Contractor shall not collect any water on the Site without prior approval of the Engineer. The Contractor shall:

1. Collect water from the source(s) indicated in this Section and prevent discharge of any water out of the Exclusion Zone.
2. Provide water collection and storage tanks on site within the Exclusion Zone. The tanks shall be equipped with readily accessible sampling ports for collecting water samples.
3. If necessary, provide pumps or other measures to dewater areas of the excavation selected by the Engineer.
4. Locate and coordinate with certified water treatment facility for the disposal of the wastewater. The Engineer shall be responsible for sampling and testing the wastewater samples and meeting the test and frequency requirements of the treatment facility.
5. Be responsible for trucking and disposing of the wastewater at the treatment facility. The Contractor shall provide wastewater disposal manifests to the Engineer.

10.0 SUBMITTALS

Within seven (7) calendar days after the Contractor has received Notice of Selection before any work has begun on the Site, the Contractor shall submit four (4) copies of the following documents including: an Excavation Work Plan, a Health and Safety Plan, an Exclusion Zone Plan, and a Remedial Action Construction Schedule to the Engineer. The required submittals and delivery dates required for these submittals are shown in Table 5.

Table 5. Contractor Submittals

Submittal	Delivery Schedule
General Excavation Work Plan and Schedule (sequence of excavation, materials handling, site layout, construction milestones, etc.)	7 days after Notice of Selection
Contractor Health and Safety Plan (HASP)	7 days after Notice of Selection
Exclusion Zone Plan (plans and procedures to maintain secure exclusion zone)	7 days after Notice of Selection
Remediation Action Construction Schedule	7 days after Notice of Selection
Backfill Material Source Identification	7 days after Notice of Selection
Backfill Material Weigh Tickets	14 days after material delivery
Wastewater Disposal Manifest	3 days after material disposal
Construction Debris Disposal Weigh Tickets	3 days after material disposal

10.1 SITE WORK RELATED SUBMITTALS

The Contractor shall submit the following Site work related documents during the entire course of the contract work:

1. Detailed Excavation Work Plan: Submit the proposed detailed sequence of excavation work at each individual excavation area for the Engineer’s approval at least seven (7) calendar days prior to commencement of excavation at that particular excavation area. The Plan shall include, at a minimum, the sequence of construction and excavation, a description of materials handling, and a description of any construction procedures specific to that excavation area. Examples of this would include the construction and management of a stormwater bypass, utility relocation, utility protection or other activities that may be required in addition to soil excavation and fill placement,. The Engineer will review and provide comments to the Contractor before the Contractor begins work at each individual excavation area.
2. Backfill Material Source Identification: Provide information regarding the source of proposed imported backfill materials to the Engineer for approval at least seven (7) calendar days prior to scheduled delivery to the Site, and provide adequate samples of the proposed materials for laboratory tests to the Engineer at this time.
3. Wastewater Disposal Manifest: Submit a copy of the wastewater disposal manifest obtained from the receiving treatment facility within 3 days after the disposal at that facility.
4. Construction Debris Disposal Weight Tickets: Submit a copy of the weight tickets obtained from the receiving construction debris landfill within 3 days after the disposal at that facility.

10.2 HEALTH AND SAFETY PLAN

The work includes the requirements for personnel health and safety to ensure adequate worker protection. The Contractor shall, at a minimum, meet all requirements of WAC 296-155, Safety Standards for Construction. Contractor shall also comply with WAC 296-62, Part P, which governs hazardous waste operations in Washington State. Hazardous waste operations regulations (including a requirement for 40-hour or 80-hour OSHA hazardous waste training) will apply whenever exposure to hazardous materials is possible. Contractor shall provide the following health and safety documents to the Engineer before the pre-construction conference at least ten (10) days before any equipment, supplies, or staff are

mobilized to the Site. The plan must be Site specific, addressing hazards at the Site. A generic plan or corporate-wide plan is not acceptable. The Engineer may halt or delay operations if Contractor does not provide an acceptable plan before the scheduled start date. An acceptable plan is a plan that meets the local, state, and federal requirements in both the opinion of the Engineer's safety staff, and the safety requirements of BNSF. The Engineer reserves the right to require future modifications to the plan to meet requirements of BNSF and of local, state and federal regulations.

The Contractor shall submit four (4) copies of the Health and Safety Plan to the Engineer a minimum of 7 days before mobilization to the Site. The Engineer will review the Health and Safety Plan and if any modifications are requested, the Contractor shall submit copies of the modified Health and Safety Plan to Engineer before beginning Site work.

Contractor shall ensure subcontractors perform their work in accordance with the HASP and all local, state and federal regulations. The Engineer reserves the right to exclude subcontractors, or subcontractor employees who perform work in an unsafe manner or who do not comply with the project Health and Safety Plan. Contractor shall supervise work of subcontractors at all times. Subcontractors shall never perform work without Contractor supervision. Exceptions to this requirement will be considered on a case-by-case basis. At least one Contractor employee shall have current first aid and CPR training while Contractor is on Site.

10.2.1 Contractor's Responsibility for Health and Safety

1. Contractor shall comply with any and all state and local ordinances and regulations.
2. Contractor shall have a duty of responsibility for the health and safety of Contractor's employees, its subcontractors, suppliers, agents, inspectors, visitors, the general public, and any others associated with or interacting with Contractor to provide labor, goods, or other services on the Site.
3. Contractor shall be responsible for emergency response planning and notification, and for actual response to any and all emergencies that may occur during the course of the work.
4. Contractor is responsible for communicating daily with the Engineer regarding health and safety issues for the Engineer's safe conduct of the Engineer's duties, but such communication shall not imply any duty or responsibility on the part of the Engineer with regard to health and safety of Contractor's employees, its subcontractors, suppliers, the general public or others. The Engineer's responsibility and duty with regard to health and safety shall be limited to the Engineer's employees. Contractor shall have responsibility and duty to the Engineer to communicate health and safety issues accurately and in a timely manner to allow the Engineer to take appropriate actions to protect the Engineer's employees and the Owner's employees.
5. Contractor is responsible for understanding and acting in accordance with all requirements of this section and the HASP for the Project.
6. Contractor shall designate a dedicated Contractor's Site Safety and Health Officer (SSHO) on the Site during the work who shall, at a minimum, have at least 3 years of experience as a SSHO on excavation projects similar to the Site, and have 40-hour OSHA Hazardous Waste Operations training and 8-hour OSHA Supervisor training. Tenure of Contractor's SSHO shall be subject to approval by the Engineer, such approval will not to be unreasonably withheld.
7. The SSHO shall be present at the Site during all Contractor activities and working hours and shall enforce the requirements of safety for all Contractor personnel on Site at all times. The SSHO shall ensure that all Contractor and its subcontractor personnel working at the Site, and

Contractor visitors, follow the HASP, including wearing the designated level of personal protection equipment (PPE). If the SSHO elects to require a higher level of protection than that specified in the HASP, the extra costs associated with such higher level shall be borne by Contractor, unless such extra costs are approved in advance in writing by the Engineer.

8. Prior to mobilization and continually through the duration of the work, the SSHO shall inspect the Site and document area-specific and worker-specific protection requirements.
9. After mobilization, the SSHO shall monitor activities and shall document the need for additional worker protection as required, based on activities performed and action levels specified in the HASP.
10. The SSHO shall verify that all activities are performed in accordance with the HASP and all federal, state, local, and health and safety standards, regulations and guidelines.
11. In the event of a health and/or safety risk as determined by the SSHO or other Contractor personnel, or as determined by the Engineer, Contractor shall not proceed with the work until a method for handling the risk has been determined in consultation with the Engineer and implemented. Any health or safety risk resulting in a stoppage of work shall be reported immediately to the Engineer.
12. Contractor shall be responsible for implementing a “Behavior Based Safety” process and provide Site training, observation, and feedback for Contractor personnel employed at the Site.

10.2.2 Contractor’s Health and Safety Submittals

Contractor shall prepare and submit a HASP to the Engineer. The Contractor shall follow all applicable local, state, and federal health and safety standards and guidelines implemented through, but not limited to, the OSHA, NIOSH, ACGIH and U.S. EPA. Where these are in conflict, the most stringent requirement shall be followed. The following points shall be addressed in the Contractor’s HASP:

- Names of key personnel with contact numbers and alternates responsible for health and safety, including a Contractor Health and Safety Representative and SSHO. The Engineer must approve the SSHO.
- A Safety Task Analysis Review (STAR) or Job Safety and Hazard Analysis (JSHA) associated with each portion of the Work (i.e., list potential chemical and physical hazards).
- Employee and sub-contractor training assignments to assure compliance with 29 CFR 1910.120.
- A requirement that Contractor locate underground utilities (if any) by using “Safe Dig” procedures prior to the start of the work.
- PPE to be used for each of the Site tasks and operations being conducted, as required by the personal protective equipment program in 29 CFR 1910.120 and 29 CFR 1926.
- Medical surveillance requirements in accordance with the program in 29 CFR 1910.120.
- Frequency and types of air monitoring, personnel monitoring, and environmental sampling techniques and instrumentation to be used by the Contractor, including methods of maintenance and calibration of monitoring and sampling equipment.
- Corrective actions and up grading of personnel protection based on monitoring of air, personnel, and environmental sampling, with specific action levels identified.

- The Site control measures in accordance with the control program required in 29 CFR 1910.120 and 29 CFR 1926.
- Decontamination procedures in accordance with 29 CFR 1910.120.
- An emergency response plan meeting federal, state, and local requirements for safe and effective responses to emergencies, including the necessary PPE and other equipment.
- Explanation of potential emergencies and contingency plan of action, including description of the route to the nearest appropriate hospital, hospital route map, and posting of emergency telephone numbers at the Site.
- A list of health and safety and emergency equipment available on the Site.
- A description of engineering controls used to reduce the hazards of equipment operation and exposure to Site hazardous chemicals.
- Lockout/Tagout where the operation of machinery and/or equipment in which the unexpected energization on start up or the release of stored energy could cause injury to personnel.

10.2.3 Notifications

Contractor shall notify the Engineer under the following circumstances:

1. Contractor shall immediately verbally report (within 30 minutes) to the Engineer and Owner the occurrence of any and all health and safety incidents. An Incident Report form or Near Miss Report form, as appropriate, shall be submitted within 48 hours of occurrence of the incident or issue.
2. Contractor shall immediately and fully investigate any such incident or near miss and conduct a root cause analysis, and shall provide to the Engineer, the Contractor's written corrective action plan for such incident within 1 day after the incident occurs.
3. Contractor shall notify the Engineer in writing at least five days prior to bringing any hazardous material, equipment, or process to the Site, or using the same on the Site. Contractor shall provide the Engineer with a MSDS for all chemicals brought on to the Site.
4. Contractor shall immediately notify the Engineer in writing of any hazard that Contractor discovers or observes on the Site and corrective measures planned or taken to eliminate or minimize such hazard. Hazard reporting will be completed as a Near Miss Report.

10.2.4 Training Requirements

Contractor shall provide the following training to each worker:

1. Initial 40-hour (or 80-hour where appropriate) OSHA Hazardous Waste Health and Safety training and current annual 8-hour refresher training.
2. Eight-hour OSHA Hazardous Waste Supervisory Training (required for the Contractor's Superintendent or SSO).
3. Completion of BNSF Contractor Orientation program on-line training course.

4. Enrollment in a medical monitoring program, with clearance within the previous 12 months from a licensed physician allowing the worker to participate in field activities and use respiratory protective equipment. Contractor shall not submit detailed medical information for employees.
5. Current respiratory fit testing certification.
6. Current CPR and first aid certification for at least one worker assigned to work on the Site.

10.2.5 Work Planning and Meetings

1. Contractor shall conduct a Daily Health and Safety Meeting prior to beginning work for that day, to address health and safety issues, changing Site conditions, activities and personnel. All Contractor and subcontractor employees working on the Site on that day shall attend the meeting. All meetings shall be documented and attendees shall sign acknowledgement of their presence at the meeting. Daily meetings will include a STAR evaluation of the work to be conducted and to document meeting attendance and discussion points.
2. Subcontractor personnel who are not in attendance for the Daily Health and Safety Meeting shall be briefed on the meeting notes upon arrival at the Site and prior to commencing their work activities. Employees shall sign acknowledgement of briefings prior to commencing work.
3. Contractor shall hold and document additional safety meetings at the start of each major task and whenever Site conditions affecting personnel safety change. Any major task undertaken will require the completion of a JSHA.

10.2.6 Engineering Controls

Contractor shall, at a minimum, provide the following engineering controls to reduce the hazards of equipment operation and exposure to Site hazardous materials:

1. Roll over cages for bulldozers, back hoes, loaders, and tractors.
2. Back-up alarms for all trucks and moving equipment.
3. Wetting of soil or other means to control dust during the work.
4. Decontamination of personnel and equipment in accordance with this Specification.
5. Others as determined to be necessary or prudent by Contractor or as directed by the Engineer.

10.2.7 Monitoring

1. Contractor shall maintain an air monitoring program and an industrial hygiene program, including the use of proper equipment for routine air monitoring, calibration records, air monitoring results, and training personnel to assist the SSHO in these duties. The Contractor should review their industrial hygiene program to insure that site-specific lead monitoring procedures are adequate.
2. Contractor shall perform heat exposure and cold exposure monitoring activities as required by weather conditions.

10.2.8 Personal Protective Equipment (PPE)

1. The appropriate level of PPE shall be determined by the Contractor for specific tasks as described in the Contractor's HASP. If hazards are identified that require a level of protection greater than Level C, work shall be suspended and the Engineer notified. The Contractor's SSHO, in

consultation with the Engineer, shall determine what actions are required prior to restarting work. Contractor shall determine and document the appropriateness of suggested minimum PPE requirements for Contractor's employees and others at the Site.

2. At a minimum, all personnel and visitors on the Site shall wear Level D PPE, except in Support Zone areas. Level D PPE consists of:
 - Hard hat.
 - Steel-toed boots.
 - Safety glasses with permanent side shields.
 - Work clothes (long pants, shirts with sleeves).
 - Orange reflective safety vests
 - Work gloves (as required).
 - Hearing protection (as required to prevent exposure to noise exceeding 85 dB)
3. Contractor shall furnish and maintain materials and equipment for the health and safety of Contractor employees, its subcontractors, suppliers, and visitor personnel. Contractor shall provide all required Health and Safety equipment, first aid equipment, tools, monitoring equipment, PPE and ancillary equipment and methods required to ensure workers health and safety and to comply with the HASP. The Engineer will furnish PPE and monitoring for Engineer's employees and Owner's employees.
4. If additional protection consisting of Level C PPE is required during work, Level C PPE will include protection from organic compounds and consist of Level D protection with the following additions:
 - Air purifying respirator, half-face or full-face (depending on required protection factor) with organic vapor/High Efficiency Particulate Air Cartridges meeting NIOSH/Mine Safety and Health Administration Specifications.
 - Disposable poly-coated chemically protective coveralls.
 - Disposable chemically resistant outer gloves (nitrile).
 - Disposable chemically resistant inner gloves (nitrile).
 - Chemically resistant, steel-toed, and steel-shanked boots (PVC, neoprene, or nitrile), or outer booties.
5. In most cases, Level C will be the maximum allowed level of PPE; however, Level B may be allowed provided that personnel are properly trained/certified and exposure levels are below IDLH conditions. The criteria that determine the required level of PPE are outlined in the Engineer's HASP.

10.2.9 Other Health and Safety Equipment

The Contractor is required to have the following equipment available on the Site for the health and safety of subcontractors, sub-subcontractors, suppliers and visitors:

1. Air monitoring instruments, including (but not limited to):
 - Organic Vapor meter.

- Combustible gas indicator.
 - Dust particulate meter.
2. First aid kits:
- Fire suppression equipment (appropriate to location and type of flammable materials present).
 - OSHA-approved emergency eyewash facilities.
 - Personnel decontamination facilities and equipment.
 - Other equipment or supplies as determined to be necessary or prudent by subcontractor or the Engineer.
 - Flammable liquids storage cabinet.
 - Fall protection equipment.

10.2.10 Evaluation of Performance

1. Contractor shall routinely conduct internal safety audits on the work to verify work is being performed in accordance with the Contractor's HASP. The focus of these routine audits will be on compliance with OSHA and local occupational safety regulations.
2. Contractor shall conduct routine behavioral observations and provide immediate feedback during work activities to promote safe behavior of Contractor employees and subcontractor employees.

10.3 EXCLUSION ZONE PLAN

The Contractor shall prepare a project-specific Exclusion Zone Plan. The plan shall locate an Exclusion Zone, a Decontamination Zone and a Support Zone. The Exclusion Zone shall contain only the activities necessary for the completion of hazardous work. The Plan shall document decontamination procedures containing, at a minimum, the following information:

- Decontamination methods and equipment that will be used.
- Procedures to prevent contamination of clean areas.
- Methods and procedures to minimize worker contact with contaminants during removal of personal protective clothing and equipment.
- Procedures for decontamination of vehicles leaving the Site.
- Procedures for disposal of clothing and equipment that is not completely decontaminated.
- Procedures for the collection, treatment, and disposal of all decontamination water, sludge and wastes.

A proposed Site layout plan is provided in the design drawings. As shown, the Exclusion Zone and Decontamination Zone shall be secured by installing temporary chain-link fence and locked during non-working hours. Access to the Exclusion Zone during working hours shall be controlled by the Contractor through a designated access point.

The Contractor shall submit two (2) copies of the Exclusion Zone Plan 7 days before mobilization to the Site.

10.4 POST-REMEDATION SUBMITTALS

Within one (1) month of conclusion of the excavation work, the Contractor shall submit copies of all manifests (or bills of lading) for any contaminated materials and construction debris transported off site; weigh scale tickets for disposed materials and/or for imported material; and any permits that required signoff by appropriate agency officials.



APPENDIX C
GEOTECHNICAL REPORT



DRAFT

**DRAFT REPORT
GEOTECHNICAL ENGINEERING SERVICES
BNSF OIL PIPELINE SITE
TACOMA, WASHINGTON**

MARCH 3, 2008

**FOR
BNSF RAILWAY COMPANY**

**Geotechnical Engineering Services
File No. 0506-141-02**

March 3, 2008

Prepared for:

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TABLE OF CONTENTS

	<u>Page No.</u>
INTRODUCTION.....	1
PROJECT UNDERSTANDING AND SCOPE.....	1
REVIEW SUMMARY.....	2
INTERIM ACTION, 2004.....	2
FINAL REMEDIAL INVESTIGATION/FEASIBILITY STUDY, 2007.....	2
SITE CONDITIONS.....	2
SITE HISTORY	2
SURFACE CONDITIONS	3
SITE GEOLOGY	3
SUBSURFACE CONDITIONS.....	3
General.....	3
Soil Conditions.....	4
Groundwater Conditions.....	4
CONCLUSIONS AND RECOMMENDATIONS.....	5
GENERAL	5
SITE PREPARATION AND EARTHWORK	5
General.....	5
Subgrade Preparation, Evaluation and Protection	5
Existing Utilities	6
Excavation Support	6
Temporary Slopes	6
FILL MATERIALS.....	7
General.....	7
Structural Fill.....	7
Select Structural Fill.....	7
Crushed Rock.....	7
Ballast (Rock Spalls)	7
STRUCTURAL FILL PLACEMENT AND COMPACTION.....	8
Settlement Considerations	8
SHEET PILE WALL.....	8
General.....	8
Earth Pressures on the Sheet Pile Wall	8
Seismic Considerations	9
Shoring Wall Alignment Considerations	9
Pile Embedment and Deflection	9
Construction Considerations	10
Excavation Dewatering.....	10
LIMITATIONS.....	11

List of Tables

Table 1. Soil Parameters Used for Pressure Diagrams and Provided for LPILE Analysis.....	9
--	---

TABLE OF CONTENTS (CONTINUED)

List of Figures

- Figure 1. Vicinity Map
- Figure 2. Overall Site Plan, Geotechnical Report
- Figure 3. Site Plan – Area A, Geotechnical Report
- Figure 4. Site Plan – Areas B and C, Geotechnical Report
- Figure 5. Site Plan – Area D, Geotechnical Report
- Figure 6. Earth Pressure Diagram (Case 1)
- Figure 7. Earth Pressure Diagram (Case 2)

APPENDICES

- APPENDIX A – INTERIM ACTION PHOTOGRAPHS, 2004
- APPENDIX B – LOG OF SELECT ENVIRONMENTAL BORINGS, 2004
- APPENDIX C – GROUNDWATER ELEVATION CONTOUR MAPS, 2004-2006
- APPENDIX D – RECENT GROUNDWATER MONITORING WELL READINGS

Appendix D Table

- Table D-1. Recent Groundwater Monitoring

- APPENDIX E – FIELD EXPLORATIONS AND LABORATORY TESTING, 2008

Appendix E Figures

- Figure E-1. Key to Exploration Logs
- Figures E-2 and E-3. Log of Borings
- Figures E-4 and E-5. CPT Logs

- APPENDIX F – REPORT LIMITATIONS AND GUIDELINES FOR USE

**DRAFT REPORT
GEOTECHNICAL ENGINEERING SERVICES
BNSF OIL PIPELINE SITE
TACOMA, WASHINGTON
FOR
BNSF RAILWAY COMPANY**

INTRODUCTION

This draft report presents the results of our geotechnical engineering studies associated with the BNSF Oil Pipeline site remediation project located in the East D Street corridor in Tacoma, Washington. The site location is shown in Figure 1. This geotechnical report is intended for inclusion in the Draft Engineering Design Report (EDR) currently being prepared by for the project. The Draft EDR is a compilation of environmental documents, along with construction plans and specifications intended for use by potential contractors to prepare a bid for the remedial excavation project described below.

The draft EDR will include structural plans and specifications for temporary sheet pile shoring walls, prepared by KPFF Consulting Engineers. All other plan sheets and specifications are to be prepared by GeoEngineers. The structural engineer will use the geotechnical information provided in this report as a basis for the structural design of the sheet pile shoring walls.

The recommended sheet pile wall layout will be prepared by GeoEngineers and is intended as a basis for contractor bidding. The selected contractor to perform the work will be requested to provide a detailed shoring design for the remedial excavation described below.

PROJECT UNDERSTANDING AND SCOPE

The project includes remedial excavation of soil contamination in four areas (Areas A through D) in the vicinity of East D Street. Excavation areas and other details are shown on the Overall Site Plan, Figure 2. The current remediation plan targets removal of soil contaminated with bunker range petroleum hydrocarbon (BRPH) with concentrations of 2,000 milligrams/kilogram (mg/kg) or greater. The aerial extent of the four proposed remediation areas is shown on Figures 3 through 5.

The proposed excavation depth is 12 feet below ground surface (bgs), with the exception of Area D, where the proposed excavation depth is 5 feet bgs. The proposed excavations are to be completed using a combination of temporary cantilevered sheet pile wall shoring and temporary open cut slopes. The proposed sheet pile wall locations and cut slope areas are shown on Figures 3 through 5.

Our understanding of site soil and groundwater conditions is based on our review of existing information and on four subsurface explorations performed specifically for this geotechnical study. The existing information includes accounts and photographs from a remedial excavation project in the vicinity of Areas B and C that was completed in 2004 (2004 interim action), and an environmental report prepared by GeoEngineers in 2007. The 2007 environmental report includes a number of boring logs in the project vicinity and provides detailed groundwater information. Our review summary is discussed in the following section of this report.

To supplement our review of existing subsurface information, we advanced two geotechnical borings (GT-1 and GT-2) on January 31, 2008, and two CPT soundings (CPT-1 and CPT-2) on February 13,

2008. Samples were obtained from the borings for geotechnical laboratory testing. The approximate location of the explorations is shown on Figures 4 and 5.

Potential difficulties associated with the completing the remedial excavation include high groundwater levels and variable subsurface conditions that include a layer of wood debris. Groundwater levels will need to be lowered within the excavation in order to facilitate excavations to 12 feet bgs, fill placement and compaction. Obstructions, including wood debris, could potentially impact sheet pile installation.

This report provides geotechnical recommendations for design and construction of temporary cantilever sheet pile walls, temporary cut slopes, and recommendations for structural fill placement and compaction. We understand that dewatering behind the sheet pile walls will not be utilized, resulting in the potential for differential hydrostatic pressure.

This report addresses two specific sheet pile wall configurations: 1) a 12-foot-high wall with a level backslope and 2) an 8-foot-high wall with a 2H:1V (horizontal:vertical) backslope. These configurations are detailed on the Earth Pressure Diagrams, Figures 6 and 7, and include a specific assumed differential hydrostatic pressure for each case. Our earth pressure diagrams have been provided to the project structural engineer, KPFF Consulting Engineers, as a basis for their sheet pile wall design. Information developed by KPFF regarding minimum sheet section size, minimum embedment depth and anticipated deflection are provided in the “Pile Embedment and Deflection” section of this report.

REVIEW SUMMARY

INTERIM ACTION, 2004

Between June 2004 and August 2004 GeoEngineers implemented an interim action remediation project in the vicinity of Areas B and C. This project included the removal of contaminated soil, wood debris and groundwater to the aerial extent identified in Figures 2 and 4 as “Interim Action Area.” The remedial excavation was completed utilizing a combination of temporary excavation cut slopes and temporary shoring. The subsurface conditions encountered in the excavation are summarized below. Representative photographs of the soil and groundwater conditions encountered during the 2004 interim action are included in Appendix A. A summary of the subsurface soil and groundwater conditions is presented in the “Subsurface Conditions” section of this report.

FINAL REMEDIAL INVESTIGATION/FEASIBILITY STUDY, 2007

We reviewed GeoEngineers report titled “Final Remedial Investigation/Feasibility Study,” dated April 4, 2007, for an understanding of site soil and groundwater conditions. This report is a compilation of environmental documents and includes subsurface soil and groundwater information. The locations of borings associated with the 2007 report (environmental borings performed in 2004), and considered relevant to this study, are shown on Figures 2 through 5. Logs of select borings are included in Appendix B. A summary of the subsurface soil and groundwater conditions is presented in the “Subsurface Conditions” section of this report.

SITE CONDITIONS

SITE HISTORY

Prior to development, the ground surface in the site and site vicinity consisted of mud flats and tidal marshes, exposed only at extreme low tides. Filling and dredging of the nearby waterways began around the beginning of the 20th Century. Located just east of the site, the Thea Foss Waterway, also known as

the City Waterway, was one of the first areas to be developed into its current configuration. By 1923, the Thea Foss Waterway had been dredged to a navigable depth, and the tidal marshes to the east of the Waterway, including the subject site, had been filled.

SURFACE CONDITIONS

The site is located east of the Thea Foss Waterway in Tacoma, Washington. This area is currently developed predominately as light industrial. The site surface is generally level and covered by asphalt, gravel and existing structures. Based on survey data provided by the City of Tacoma, Areas A, B and C are around Elevation 15 feet mean lower low water (MLLW). Area D is near Elevation 20 feet (MLLW). The existing site conditions and topography are shown in Figures 2 through 5.

SITE GEOLOGY

The geology in the project area is predominantly comprised of river delta deposits of the Puyallup River, Hylebos Creek, Wapato Creek and their ancestral predecessors. The deposition began after glacial ice had retreated north into present-day Canada and the sea had filled in what is now Puget Sound.

Geologic conditions at the site were evaluated in part by reviewing the “Geologic Map of the Tacoma North 7.5-Minute Quadrangle” (Troost, K.G., and Booth, D.B., in review). The map classifies the site and surrounding areas as Artificial Fill (map unit ‘af’). The artificial fill in the area is described to “variously consist of gravel, sand, silt, concrete, garbage, and other materials.”

We also reviewed “Geology of the Port of Tacoma,” produced by Hart Crowser and Associates Inc. This publication indicates that borings “Loop 5,” “Loop 9” and “Loop 11” were advanced in the vicinity of the site. In general, boring Loop 5 is in the vicinity of Area A, Loop 9 is in the vicinity of Areas B and C and Loop 11 is near Area D. Information from these borings indicates that the soil profile typically consists of 10 to 20 feet of very loose to medium dense fill overlying a 30- to 70-foot-thick layer of very loose to medium dense alluvium mostly consisting of silty sand. Very dense glacially consolidated deposits are indicated below the alluvium in the borings. Based on Cross Section II-II’ of the Hart Crowser publication, depth to glacially consolidated soil is about 50 feet bgs in Areas A, B and C, and about 110 feet bgs in Area D.

SUBSURFACE CONDITIONS

General

We consider the subsurface conditions encountered in our 2008 explorations to be generally consistent with the existing information obtained from our review. For the purposes of this report, we classify the subsurface materials into three general units: 1) Soil fill, 2) Wood debris fill and 3) Native alluvium. For our use in preparing pressure diagrams for the temporary sheet pile wall design, we assumed certain layer thicknesses and engineering soil properties. These assumptions are provided on Table 1. Detailed descriptions of the subsurface soil conditions are provided in the following sections.

Based on our review and 2008 geotechnical explorations, we interpret groundwater at the site to be tidally influenced and generally present near the levels indicated on the Groundwater Elevation Contour Maps in Appendix C. Recent depth-to-groundwater measurements from monitoring wells installed in 2004 borings are provided in Appendix D, Table D-1. Detailed descriptions of site groundwater conditions are provided in the following sections. For a detailed understanding of site groundwater conditions, including specific information regarding tidal influence, we recommend that our 2007 environmental report be reviewed.

Soil Conditions

Interim Action, 2004

On average, excavations performed during the 2004 interim action extended to approximately 12 to 13 feet bgs. Conditions exposed in the excavation sidewalls generally consisted of 2 to 5 feet of soil fill overlying 5 to 10 feet of wood debris. Underlying the wood debris, the base of the excavation generally exposed native alluvial soils consisting of sand and silty sand.

Final Remedial Investigation/Feasibility Study, 2007

Based on our review of the boring logs included in the 2007 study (environment borings performed in 2004), we interpret the soil fill and wood debris to extend from the asphalt/gravel surface to depths of between approximately 10 and 13 feet bgs. Below the soil fill and/or wood debris fill, we interpret the native alluvium material to extend to the depths explored.

Geotechnical Explorations, 2008

At our exploration locations (GT-1, GT-2, CPT-1, CPT-2), we interpret the soil fill unit to extend from the asphalt/gravel surface to depths of between approximately 3 and 6 feet bgs. Below the soil fill unit, we interpret the wood debris fill unit to extend to depths of between approximately 10 and 12 feet bgs. Below the wood debris fill unit, we interpret the native alluvium unit to extend to the depths explored. Detailed descriptions of our 2008 field explorations, laboratory testing and summary exploration logs are presented in Appendix E.

Groundwater Conditions

Interim Action, 2004

Groundwater conditions encountered during the 2004 interim action excavation activities varied significantly due to encountering a damaged stormwater line within the excavation. This stormwater line and its pipe bedding material were observed to act as a conduit between the excavation and the adjacent Thea Foss Waterway. The following points summarize our understanding of groundwater encountered during the 2004 interim action:

- Groundwater was typically encountered during excavation at depths ranging from 6 to 10 feet bgs.
- In the most severe case, the water level inside the excavation varied by 4 to 8 feet due to tidal influence. This high variability in water level was attributed to effects of the “conduit” described above.
- At its highest point, the water level in the excavation reached 4 feet bgs.
- Water was pumped from the excavation on a daily basis to facilitate excavation, fill placement and compaction.

Final Remedial Investigation/Feasibility Study, 2007

Groundwater information provided in our 2007 environmental report is complex, and most of the information is beyond the considerations of this geotechnical study. We have excerpted relevant information from the 2007 study, which has been included in the Appendices of this report. Our general understanding of site groundwater levels as a result of our review is as follows:

- We expect site groundwater levels are near the elevations shown on the Groundwater Elevation Contour Maps, Appendix C.

- We expect that tidal influence on site groundwater level is on the order of 1 to 2 feet, when not influenced by direct conduits to adjacent bodies of water.

Geotechnical Explorations, 2008

Groundwater was encountered during drilling in explorations GT-1 and GT-2 at depths of 12 and 8 feet bgs, respectively.

CONCLUSIONS AND RECOMMENDATIONS

GENERAL

Based on our review of the existing site subsurface information and results of our 2008 geotechnical explorations, it is our opinion that the proposed remedial excavation is generally feasible from a geotechnical standpoint, provided that the recommendations presented in this report are incorporated into design and construction.

We have developed earth pressure diagrams and provided them to the structural engineer for use in the design of temporary cantilevered sheet pile walls. These diagrams, Case 1 and Case 2, are provided as Figures 6 and 7, respectively. In this report, we have included information developed by the structural engineer regarding minimum wall embedment, minimum sheet section thickness and anticipated wall deflection.

We anticipate that dewatering within the excavation will be needed to advance the excavation to the target depth of 12 feet bgs, and to facilitate structural fill placement and compaction. However, dewatering will not be utilized outside of the excavation footprint due to environmental considerations. General considerations for dewatering inside the excavation are discussed in the “Excavation Dewatering” section of this report.

Based on our understanding of the site subsurface soil and groundwater conditions, we anticipate the following will be required to complete the proposed excavation. Slope protection will be needed to maintain temporary slopes. Rock spalls or crushed rock will be needed to elevate the subgrade surface above the water table to facilitate structural fill placement and compaction. Sheet pile wall embedment could be compromised by overexcavating at the base of the wall, resulting in increased wall deflection; to address this we recommend the use of a rock spall toe buttress. These concerns are further discussed in the following sections of this report.

SITE PREPARATION AND EARTHWORK

General

We anticipate that site preparation and earthwork will include removing pavements as needed, relocating and/or protecting utilities, installing sheet pile wall sections, cutting back temporary excavation slopes, implementing temporary erosion controls specified on the plans, excavating, dewatering, placing rock spalls or crushed rock inside the excavation to a level above the water table, and placing and compacting structural fill. We expect that most of the site grading can be accomplished with conventional earthmoving equipment in proper working condition. Recommendations for earthwork, site development and fill materials are presented in the following sections.

Subgrade Preparation, Evaluation and Protection

We recognize that the site soils exposed in the base of the excavation are unlikely to be compacted into an unyielding condition because of their high fines content and likely submerged condition. Therefore, we

recommend rock spalls or crushed rock be placed in the base of the excavation to advance the subgrade elevation above the water table and facilitate structural fill placement and compaction. We recommend that the subgrade surface and rock placement be observed by a member of our firm prior to placement of structural fill.

Existing Utilities

Numerous above and below ground utilities are currently located within or near the proposed excavation locations. In addition, several utilities have been abandoned in place including portions of the former oil pipeline and numerous underground storage tanks (USTs). The utilities shown on Figures 2 through 5 have been approximately located by methods such as public/private utility locate service, survey of existing monuments and historic data. The locations should be considered approximate and field verified by the contractor prior to beginning work. The utilities within or near the proposed excavation will need to be supported during construction or relocated.

Excavation Support

Excavations deeper than 4 feet should be shored or laid back at a stable 2H:1V slope if workers are required to enter. Shoring for utility excavations must conform to the provisions of Title 296 Washington Administrative Code (WAC), Part N, "Excavation, Trenching and Shoring." Regardless of the soil type encountered in the excavation, shoring or sloped sidewalls will be required under the Washington Industrial Safety and Health Act (WISHA). Although this report describes certain approaches to excavation, the contract documents should specify that the contractor is responsible for selecting excavation methods, monitoring the excavations for safety and providing shoring, as required, to protect personnel and adjacent structures. Additional recommendations for excavation support are provided in the "Temporary Slopes" and "Sheet Pile Wall" sections of this report.

Temporary Slopes

General

For planning purposes, we recommend that temporary slopes be inclined no steeper than 2H:1V. This inclination is provided as an average over the proposed 12-foot-deep excavation and does not account for substantial erosion and undercutting due to unprotected slopes. This guideline assumes that all surface loads are kept at a minimum distance of at least one-half the depth of the cut away from the top of the slope. Where such slopes are not practical, temporary shoring should be used to protect workers and equipment. Ultimately, because the contractor has control over the excavation, it is their responsibility to provide safe working conditions on and around slopes.

Slope Protection and Erosion Control

Temporary slopes should be protected from erosion and disturbance. Based on the construction sequences in the 2004 Interim Action, it is our opinion that the most effective way to protect temporary slopes is to immediately cover/buttress the slope face with crushed rock or rock spalls. Alternatively, covering the slopes with steel plates/sheets would help reduce erosion, raveling and construction disturbance, and may provide confinement of the sloped material.

It is the responsibility of the contractor to protect the slopes from erosion. Without proper erosion protection, it should be assumed that the fluctuating water levels will erode the temporary slopes, eventually requiring the top of slope to be moved back to maintain a temporary 2H:1V slope. If erosion is not controlled, shoring may ultimately be needed. We recommend that bids submitted by contractors include specific methods proposed for slope protection and erosion control.

FILL MATERIALS

General

The suitability of material used as fill will depend on the gradation and moisture content of the soil. As the amount of fines (material passing the U.S. No. 200 sieve) increases, soil becomes increasingly sensitive to small changes in moisture content, and adequate compaction becomes more difficult, if not impossible, to achieve. We recommend that select structural fill or crushed rock be used as structural fill during the rainy season (typically October through May). The following sections summarize the material requirements for fill and backfill.

Structural Fill

Structural fill should be used as backfill material for the proposed excavations once the subgrade elevation has been brought above the prevailing groundwater table using rock spalls or crushed rock. Many soil types can be considered for use as structural fill during periods of dry weather, provided they are properly moisture-conditioned and free of roots, organic matter and other deleterious materials and do not contain particles larger than 8 inches in diameter. However, due to the high groundwater levels on this site we recommend extreme caution be used when attempting to use any structural fill material with more than 5 percent fines content by weight.

We do not anticipate an on-site source of structural fill will be available for this project; the project targets removal of contaminated soil. We anticipate that the selection of structural fill material will be subject to the environmental constraints associated with the project.

Select Structural Fill

Select structural fill should consist of imported, well-graded sand, sandy gravel or crushed rock with a maximum particle size of 3 inches and less than 5 percent passing a U.S. No. 200 sieve based on the minus ¾-inch fraction. This material should be free of organic matter, debris and other deleterious material. Select structural fill used during periods of prolonged dry weather may have up to 10 percent passing a U.S. No. 200 sieve.

Crushed Rock

Crushed rock fill should consist of clean, durable, crushed angular rock that has a maximum particle size of 2 inches, should be well graded between coarse and fine sizes and should have less than 5 percent fines (material passing a U.S. No. 200 sieve). Crushed rock should generally conform to shoulder ballast as defined in 9-03.9(2) of the Washington State Department of Transportation (WSDOT) "Standard Specifications for Road, Bridge and Municipal Construction," 2008. Crushed rock should be crushed to have at least two fractured faces. Crushed rock fill should be free of organic matter, debris and other deleterious material.

Ballast (Rock Spalls)

Rock spall material should consist of clean, durable, angular rock that has a maximum particle size gradation of 2 to 8 inches. This material is typically ordered in 2- to 4-inch or 4- to 8-inch gradation. Rock spalls should be free of organic matter, debris and any material less than 2 inches in size.

STRUCTURAL FILL PLACEMENT AND COMPACTION

Prior to structural fill placement, the subgrade surface should be elevated above the groundwater table by placing rock spalls or crushed rock, compacted in place using the bucket of an excavator. We anticipate that the thickness of the rock layer will be variable and depend on the effectiveness of dewatering measures, as discussed in the “Excavation Dewatering” section of this report.

Structural fill should be compacted at a moisture content near optimum. The maximum allowable moisture content varies with the soil gradation and should be evaluated during construction. Clayey soils and other fine granular soils can be difficult or impossible to compact during persistent wet conditions.

Structural fill material should be placed in uniform, horizontal lifts and uniformly densified with vibratory compaction equipment. The maximum lift thickness will vary depending on the material, compaction equipment used and required degree of compaction, but it should generally not exceed 10 inches in loose thickness for structural fill.

We recommend that structural fill be compacted to at least 95 percent of the maximum dry density (MDD) estimated in general accordance with American Society for Testing and Materials (ASTM) Test Method D 1557 (modified Proctor).

Settlement Considerations

If some settlement of structural fill is acceptable, structural fill more than 2 feet below planned pavements should be compacted to at least 90 percent of the MDD. The magnitude of settlement after the remedial excavations have been backfilled will depend on the type of structural fill material used, percentage of the MDD achieved, the effectiveness of the rock spall material in providing an unyielding subgrade, and the composition of material in the base of the excavation.

In general, we anticipate that settlement resulting from areas backfilled utilizing 90 percent compaction at depth would not exceed the likely on-going settlement of adjacent areas underlain by the wood debris fill unit. We are available to discuss pavement and pavement performance expectations with the respective property owners on a case-by-case basis, if requested.

SHEET PILE WALL

General

We have prepared earth pressure diagrams for the KPFF’s use in developing wall sections and minimum embedment lengths. We also provided KPFF with LPILE soil parameters for use in estimating wall deflection. The soil parameters used in our analyses and provided to KPFF are provided in Table 1.

In the following sections, we discuss earth pressure diagrams, information developed by the structural engineer and construction issues. The wall location, embedment depth requirement, section thickness and construction procedures should be in accordance with the final plans and specifications.

Earth Pressures on the Sheet Pile Wall

Our analysis assumed two design scenarios, Case 1 and Case 2. The differences are wall height, differential hydrostatic pressure, traffic surcharge loading and the sloping conditions above the wall. Resultant soil pressure diagrams and assumed geometry are shown in Figures 6 and 7.

Our selection of soil parameters is based on our review, explorations, laboratory test results, experience and judgment. The soil parameters used in our analyses are provided below on Table 1.

Table 1. Soil Parameters Used for Pressure Diagrams and Provided for LPILE Analysis

Soil Type 1) Per This Report 2) Per LPILE	Depth Range bgs (feet)	LPILE K Value (pci)	C, Cohesion (psf)	Friction Angle (degrees)	Active Earth Pressure Coefficient. Ka	Passive Earth Pressure Coefficient. Kp	Moist Unit Weight (pcf)	Wet Unit Weight (pcf)
1) Soil Fill 2) Sand	0 to 4	N/A	0	32	0.307	N/A	105	N/A
1) Wood Debris Fill 2) Sand	4 to 12	N/A	0	32	0.307	N/A	80	85
1) Alluvium 2) Sand	12 and below	15	0	30	0.333	3.00	N/A	110

Notes:

pci = pounds per cubic inch
psf = pounds per square foot
Ka and Kp are unitless
pcf = pounds per cubic foot

Seismic Considerations

It is our opinion that the probability of a seismic event occurring when the full wall height is exposed is low. We do not know how long the wall will be exposed; however, we expect that it will be on the order of months, not years. Therefore, because of the temporary condition of the sheet pile wall, the soil parameters above and resultant pressure diagrams do not consider seismic loads. Should seismic design parameters be needed, we are available to provide supplemental consultation.

Shoring Wall Alignment Considerations

For temporary sheet pile shoring wall installation, we have assumed a minimum horizontal setback distance from existing structures equal to the excavation depth. Our earth pressure diagram analyses did not take into account surcharge loads that might be induced by structures. If sheet pile walls are to be placed closer than the recommended setback distances indicated on Figure 4, or if surcharge loads exceed those stated on Figures 6 and 7, wall bracing should be anticipated. This may include tiebacks, internal bracing, toe buttress methods and staged excavations.

Pile Embedment and Deflection

Information developed by the structural engineer indicates that minimum sheet sizes of AZ 25 and AZ 12 will be required, for Case 1 and Case 2, respectively. We understand that minimum embedment depths are 35 and 24 feet below the base of excavation for Case 1 and Case 2, respectively. Thus, minimum sheet lengths of 47 and 36 feet are anticipated.

Based on the above sheet sizes, specified minimum embedment and LPILE soil parameters we provided, deflections at the top of the wall of 2.0 to 3.0 and 1.25 to 2.0 inches have been estimated by the structural engineer for Cases 1 and 2, respectively.

We consider these deflections conservative given that the analyses assumed a large, permanent uneven distribution of hydrostatic pressure, as indicated on Figures 6 and 7. Elevated water within the excavation, structural fill placement and the recommended rock spall toe buttress discussed below should reduce the actual deflection.

Construction Considerations

General

We anticipate that the sheet piles can be driven to the design embedment using a vibratory or impact hammer. The contractor should be prepared to handle obstructions, particularly within the wood debris fill. Appendix A of this report presents several photographs from the 2004 Interim Action that, to the best of our knowledge, represent the general makeup of the wood debris fill unit.

Even though the results of our review and subsurface explorations indicate reasonably consistent soil conditions along the wall alignment, it is possible that driving conditions may vary. Therefore, some contingency should be included in the project construction budget for variations in driving behavior that may impact driving time (for example, encountering large buried wood, concrete or other debris).

The water level behind the sheet pile walls should not be allowed rise above that shown on Figures 6 and 7 (4 and 6 feet bgs in Figures 6 and 7, respectively). Accordingly, we recommend that weep holes be cut in the face of some of the sheet piles. The selected contractor should propose specific methods in their design for maintaining the groundwater level behind sheet pile walls.

The layout of the sheet pile walls is provided on Figure 4. Placement is intended to maximize removal of contaminated soil while not endangering the foundations of neighboring buildings. Under no circumstances should the sheet piles be placed closer to a building than the depth of excavation, 12 feet, as indicated on Figure 4.

Excavation Dewatering

Based on the groundwater conditions encountered during the 2004 Interim Action and information provided in our 2007 report, we expect that tidal effects will result in fluctuating water levels inside the excavation. We anticipate that the magnitude of tidal influence will depend on the presence of preferential pathways/conduits between the excavation and adjacent water surfaces such as the Thea Foss Waterway. At a minimum, we anticipate water levels will fluctuate on the order of 1 to 2 feet.

Our observations from the 2004 interim action excavation suggest that 4 feet of standing water inside the excavation is the upper limit in which a contractor can work. Accordingly, and based on site grades and anticipated groundwater levels, we anticipate dewatering will be needed to drop the water level inside the excavation by 4 feet on average. Additional dewatering could potentially reduce the thickness of the rock spall/crushed rock layer recommended to bring the subgrade surface above the water level. We anticipate additional dewatering may be needed in excavations that encounter conduits to adjacent bodies of water.

Rock Spall Toe Buttress

After sheet pile installation, excavations in front of the sheet pile wall should be limited to 10-foot-wide sections when excavating deeper than 9 feet bgs. The lower 3 feet of material inside the excavation (9 to 12 feet bgs) should be replaced with a rock spall toe buttress immediately after its excavation. This buttress should be a minimum of 3 feet high, level, and extend perpendicular to the wall face for at least 5 feet.

Vibrations Monitoring and Deflection Survey

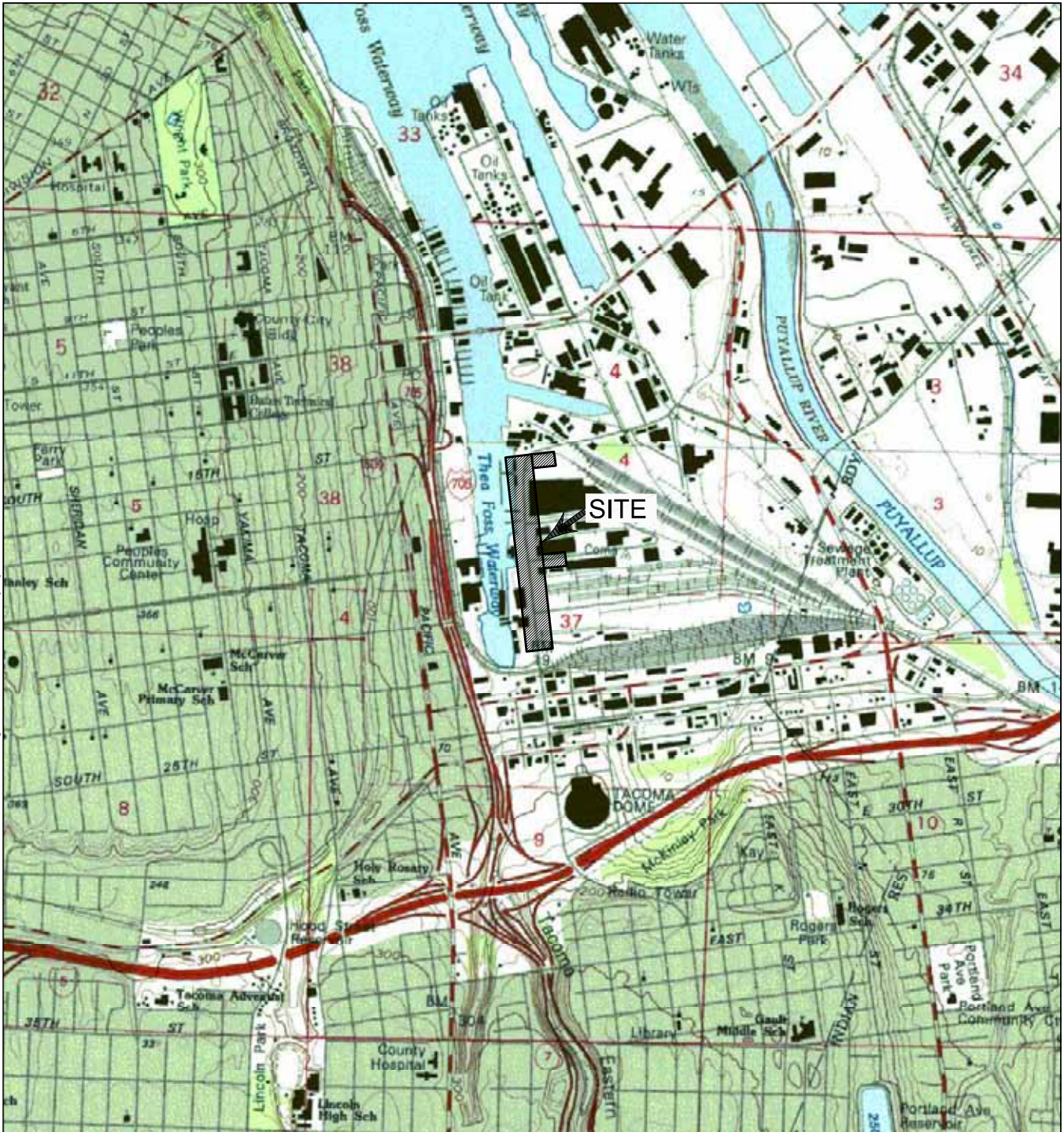
We recommend that a vibrations monitoring program be implemented to measure the vibration of adjacent structures and critical site features during sheet pile installation. We also recommend that survey points be set up on existing site features and on the sheet pile wall to measure potential deflection.

LIMITATIONS

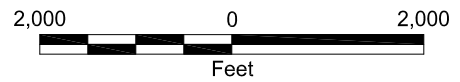
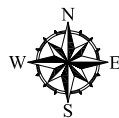
We have prepared this report for the exclusive use of BNSF Railway Company and their authorized agents for the oil pipeline remediation project in Tacoma, Washington.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practices in the field of geotechnical engineering in this area at the time this report was prepared. No warranty or other conditions, express or implied, should be understood.

Please refer to Appendix F titled “Report Limitations and Guidelines for Use” for additional information pertaining to use of this report.



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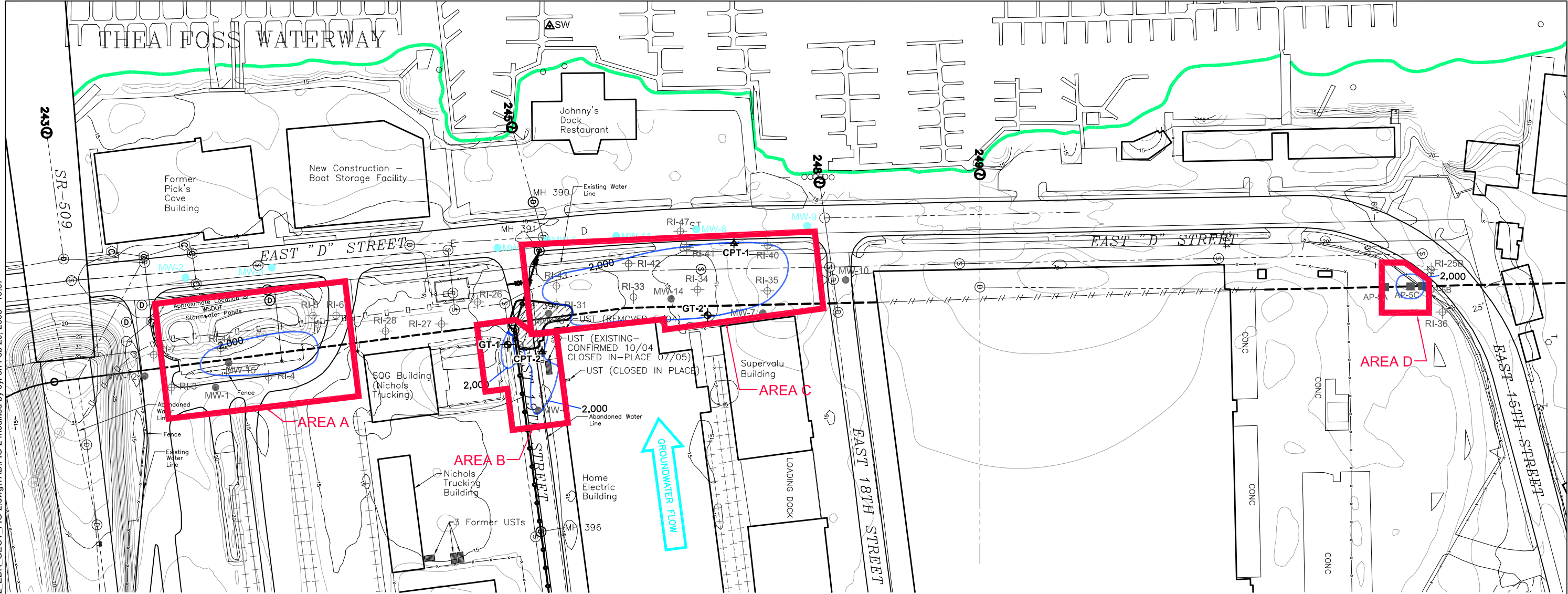
Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Reference: Sure Maps! Raster Maps- USGS based quadrangles.

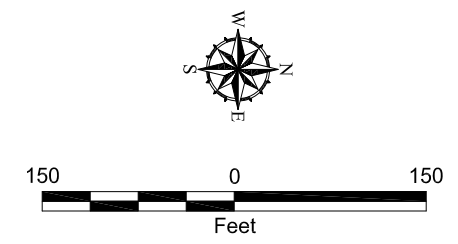
Vicinity Map Geotechnical Report	
BNSF Oil Pipeline Site (D Street) Tacoma, Washington	
GEOENGINEERS	Figure 1

P:\10050614\102\CAD\TSC\EDR\GEO\050614102_EDR_GEO_TFIG-2.dwg\TAB:FIG-2 modified by syr on Feb 29, 2008 - 10:37
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EXPLANATION:

- | | | | | | | | |
|--------------|--|-----------|---|--|---|--|-------------------------------|
| GT-1 | BORING NUMBER AND APPROXIMATE LOCATION | SW | STILLING WELL LOCATION | | THEA FOSS SHORELINE | | BRPH CONCENTRATIONS |
| CPT-1 | CONE PENETROMETER TEST NUMBER AND APPROXIMATE LOCATION | | STORMWATER OUTFALL | | LIMITS OF 2004 INTERIM REMEDIAL EXCAVATION | | 2,000 mg/kg |
| MW-1 | MONITORING WELL | | SEWER MANHOLE | | APPROXIMATE LIMITS OF PROPOSED REMEDIAL AREAS | | mg/kg MILLIGRAMS PER KILOGRAM |
| MW-5 | MONITORING WELL LOCATION AT THE CONDITIONAL POINTS OF COMPLIANCE | | CATCH BASIN | | | | |
| RI-42 | 2004 REMEDIAL INVESTIGATION BORING | | STORMWATER MANHOLE | | | | |
| AP-5A | 2002 PIPELINE ACCESS PIT | | HISTORIC PIPELINE ALIGNMENT | | | | |
| | | | PIPELINE REMOVED | | | | |
| | | | PIPELINE GROUTED IN PLACE | | | | |
| | | | SLIP-LINED STORM DRAIN | | | | |
| | | | STORM DRAIN HAS BEEN REPLACED | | | | |
| | | | ABANDONED 15-INCH PLASTIC SANITARY SEWER PIPE | | | | |



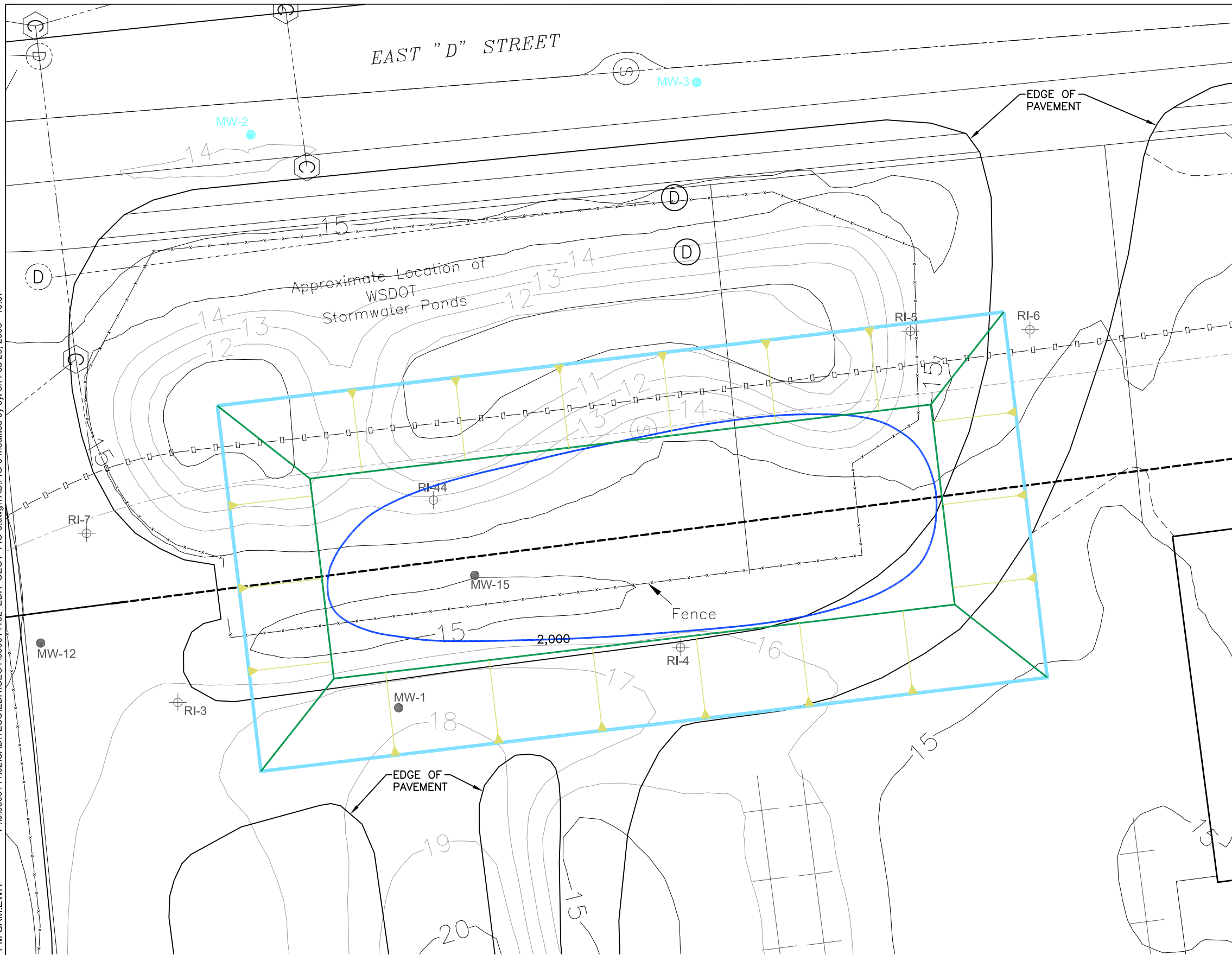
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Notes:
 1. The locations of all features shown are approximate.
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Reference: Drawing created from AutoCAD file, E.D st-oil line-b.DWG", provided by City of Tacoma.

Overall Site Plan Geotechnical Report	
BNSF Oil Pipeline Site (D Street) Tacoma, Washington	
GEOENGINEERS	Figure 2

P:\0050614102\CAD\TSC\EDR\GEO\050614102_EDR_GEO_TFIG-3.dwg\TAB:FIG-3 modified by syj on Feb 29, 2008 - 10:37
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- EXPLANATION:**
- MW-1 ● MONITORING WELL
 - MW-5 ● MONITORING WELL LOCATION AT THE CONDITIONAL POINTS OF COMPLIANCE
 - RI-42 ⊕ 2004 REMEDIAL INVESTIGATION BORING
 - ⊙ STORMWATER OUTFALL
 - ⊙ SEWER MANHOLE
 - ⊙ CATCH BASIN
 - ⊙ STORMWATER MANHOLE
 - HISTORIC PIPELINE ALIGNMENT
 - - - PIPELINE REMOVED
 - - - PIPELINE GROUTED IN PLACE
 - □ - □ - ABANDONED 15-INCH PLASTIC SANITARY SEWER PIPE
- BRPH CONCENTRATIONS**
- 2,000 mg/kg
 - mg/kg MILLIGRAMS PER KILOGRAM
 - SLOPED EXCAVATION - TOP OF SLOPE
 - EXCAVATION SLOPE
 - TOE OF EXCAVATION SLOPE

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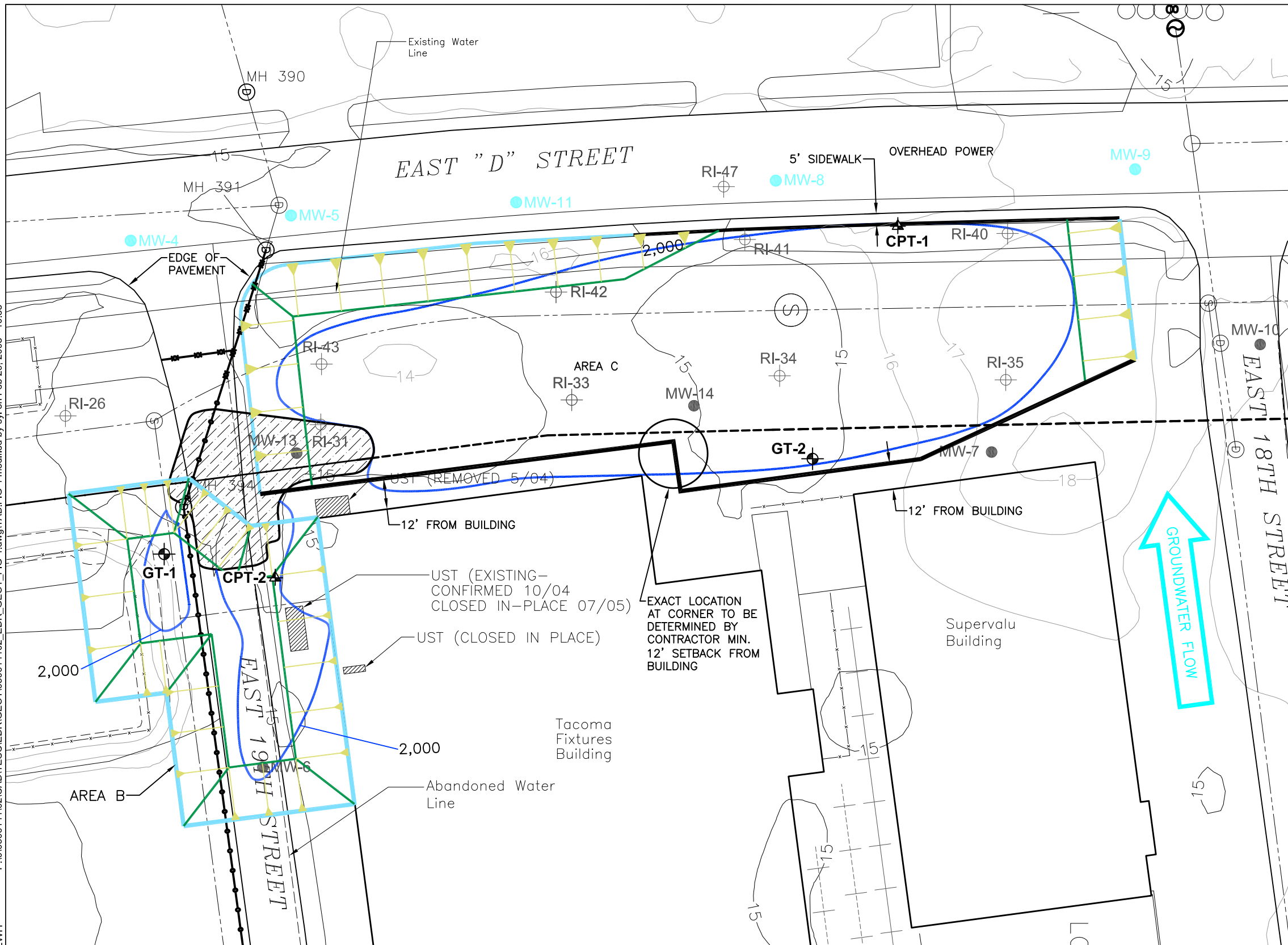
Site Plan - Area A Geotechnical Report	
BNSF Oil Pipeline Site (D Street) Tacoma, Washington	
GEOENGINEERS	Figure 3

Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

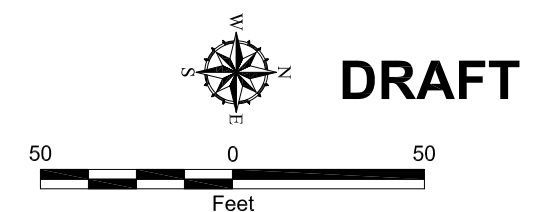
Reference: Drawing created from AutoCAD file, E.D st-oil line-b.DWG", provided by City of Tacoma.

P:\101050614\102\CAD\TIES\DRG\050614102_EDR_GEO_TFIG-4.dwg\TAB:FIG-4 modified by syj on Feb 29, 2006 - 10:38
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EXPLANATION:

- GT-1** BORING NUMBER AND APPROXIMATE LOCATION
- CPT-1** CONE PENETROMETER TEST NUMBER AND APPROXIMATE LOCATION
- MW-1** MONITORING WELL
- MW-5** MONITORING WELL LOCATION AT THE CONDITIONAL POINTS OF COMPLIANCE
- RI-42** 2004 REMEDIAL INVESTIGATION BORING
- STORMWATER OUTFALL
- SEWER MANHOLE
- CATCH BASIN
- STORMWATER MANHOLE
- HISTORIC PIPELINE ALIGNMENT
- PIPELINE REMOVED
- PIPELINE GROUTED IN PLACE
- SLIP-LINED STORM DRAIN
- STORM DRAIN HAS BEEN REPLACED
- ABANDONED 15-INCH PLASTIC SANITARY SEWER PIPE
- LIMITS OF 2004 INTERIM REMEDIAL EXCAVATION
- BRPH CONCENTRATIONS**
- 2,000 mg/kg
- mg/kg
- SLOPED EXCAVATION - TOP OF SLOPE
- EXCAVATION SLOPE
- TOE OF EXCAVATION SLOPE
- SHEET PILE WALL LOCATION



Site Plan - Areas B and C Geotechnical Report	
BNSF Oil Pipeline Site (D Street) Tacoma, Washington	
	Figure 4

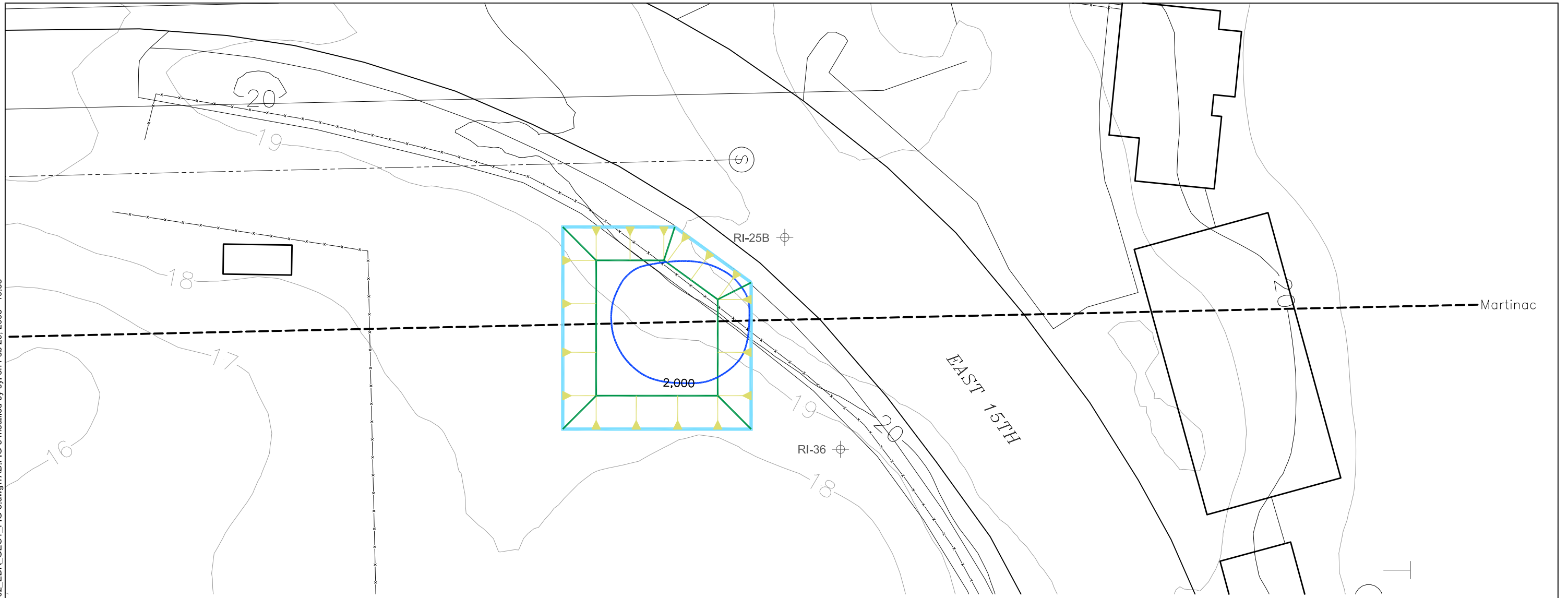
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2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.





Reference: Drawing created from AutoCAD file, E.D st-oil line-b.DWG", provided by City of Tacoma.






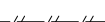
P:\0050614102\CAD\TSC\EDR\GEO\050614102_EDR_GEO_TFIG-5.dwg\TAB:FIG-5 modified by syj on Feb 29, 2006 - 10:38

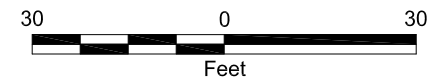
OFFICE:TACO PM CAM:EWB



EXPLANATION:

-  SLOPED EXCAVATION - TOP OF SLOPE
-  EXCAVATION SLOPE
-  TOE OF EXCAVATION SLOPE
- BRPH CONCENTRATIONS
-  2,000 mg/kg
- mg/kg MILLIGRAMS PER KILOGRAM

-  RI-41 2004 REMEDIAL INVESTIGATION BORING
-  STORMWATER OUTFALL
-  SEWER MANHOLE
-  STORMWATER MANHOLE
-  PIPELINE GROUTED IN PLACE
-  PIPELINE PRESENCE UNKNOWN



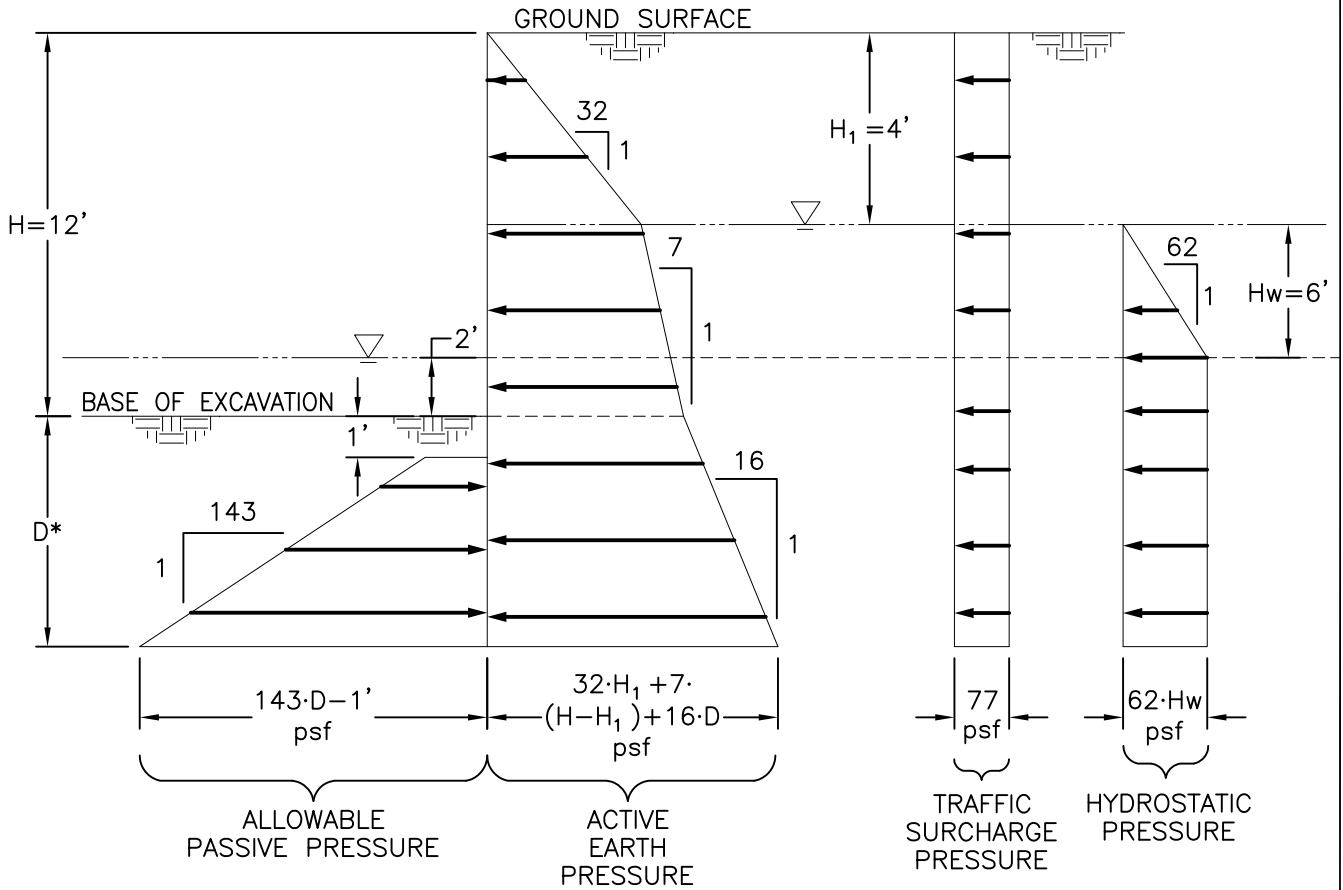
DRAFT

Notes:
 1. The locations of all features shown are approximate.
 2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Reference: Drawing created from AutoCAD file, E.D st-oil line-b.DWG", provided by City of Tacoma.

Site Plan - Area D Geotechnical Report	
BNSF Oil Pipeline Site (D Street) Tacoma, Washington	
GEOENGINEERS 	Figure 5

TEMPORARY CANTILEVER SHEET PILE WALL



NOT TO SCALE

LEGEND:

- H = HEIGHT OF SHEET PILE WALL, FEET
- H_w = HEIGHT OF UNEVEN HYDROSTATIC PRESSURE, FEET
- H₁ = MINIMUM ALLOWABLE DEPTH TO GROUNDWATER, FEET
- *D = SHEET PILE EMBEDMENT, FEET, TO BE DETERMINED BY STRUCTURAL ENGINEER

DRAFT

Notes:

1. This pressure diagram is appropriate for temporary sheet pile walls. If additional surcharge loading (such as from soil stockpiles, excavators, dumptrucks, cranes, or concrete trucks) is anticipated, GeoEngineers should be consulted to provide revised surcharge pressures.

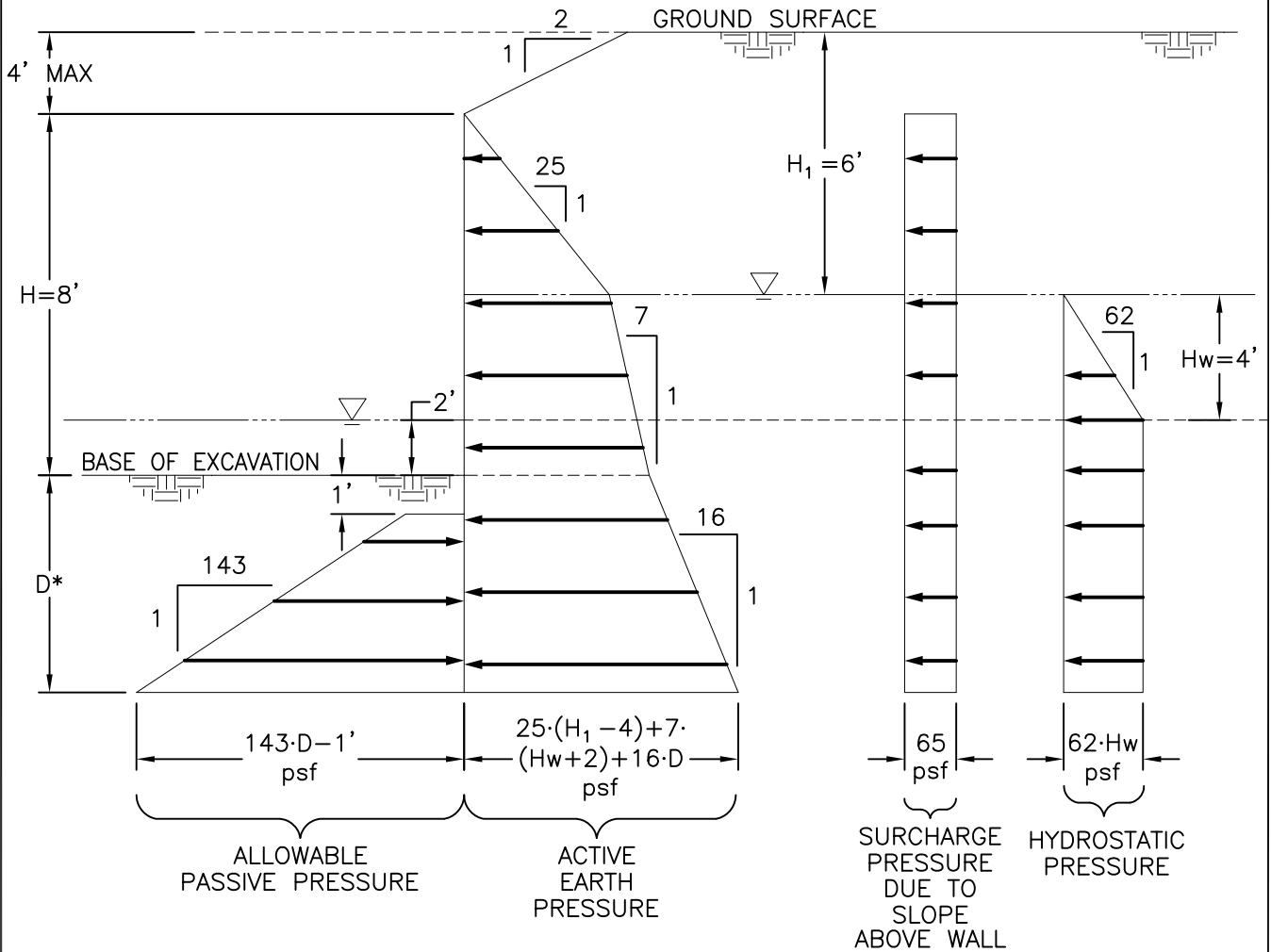
Earth Pressure Diagram (Case 1)

BNSF Oil Pipeline Site (D Street)
Tacoma, Washington

GEOENGINEERS 

Figure 6

TEMPORARY CANTILEVER SHEET PILE WALL



NOT TO SCALE

LEGEND:

- H = HEIGHT OF SHEET PILE WALL, FEET
- H_w = HEIGHT OF UNEVEN HYDROSTATIC PRESSURE, FEET
- H_1 = MINIMUM ALLOWABLE DEPTH TO GROUNDWATER, FEET
- *D = SHEET PILE EMBEDMENT, FEET, TO BE DETERMINED BY STRUCTURAL ENGINEER

DRAFT

Notes:

1. This pressure diagram is appropriate for temporary sheet pile walls. If additional surcharge loading (such as from soil stockpiles, excavators, dumptrucks, cranes, or concrete trucks) is anticipated, GeoEngineers should be consulted to provide revised surcharge pressures.

Earth Pressure Diagram (Case 2)

BNSF Oil Pipeline Site (D Street)
Tacoma, Washington

GEOENGINEERS 

Figure 7

APPENDIX A
INTERIM ACTION PHOTOGRAPHS, 2004

APPENDIX A
INTERIM ACTION PHOTOGRAPHS, 2004



Photo 1
Site conditions, note size of wood debris in
wood fill, large log in foreground



Photo 2
Site conditions, note thickness of soil fill overlying
wood fill



Photo 3
Wood debris, note thickness of soil fill and size of
wood debris



Photo 4
Wood debris, note water approximately 10 feet
below ground surface (jersey barrier for scale)



Photo 5
Backfill, note crushed rock placed in excavation providing erosion control and confinement of cut slope



Photo 6
Backfill, dewatering accomplished with portable pump, note size and type of wood debris

APPENDIX B
LOGS OF SELECT ENVIRONMENTAL BORINGS, 2004

Date(s) Drilled	03/15/04	Logged By	NER/DAR	Checked By	SLF
Drilling Contractor	Holt Drilling	Drilling Method	Stratprobe	Sampling Methods	Continuous
Auger Data	1.5 inch Standard SPT	Hammer Data		Drilling Equipment	Hydraulic & Percussion Drilling
Total Depth (ft)	14	Surface Elevation (ft)		Groundwater Level (ft. bgs)	9
Datum/ System					

Depth feet	SAMPLES				Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, lbs/ft ³	OTHER TESTS AND NOTES
	Interval	Number	Recovered (in)	Blows/foot							
0						AC	3.5 inches asphalt				
		18				GP	Gray -5/8 inch top course (dense, moist)				
						SP-SM	Brown fine to medium sand with silt and gravel (dense, moist) (fill)				
		24				SP	Gray fine to medium sand with trace silt and occasional gravel (medium dense, moist) (fill?)				
5		24				ML	Gray silt with sand and occasional gravel (medium stiff, moist) (fill?)				
						SP-SM	Dark gray fine to medium sand with silt (medium dense, moist) (fill?)				
		1	24			ML	Gray silt with sand and occasional gravel (medium stiff, moist)				
						WD	Brown wood debris with product globules (loose, moist)				
10		2	24								
						SP-SM	Dark gray fine sand with silt (medium dense, wet)				
		24									
						SP	Dark gray fine to medium sand with trace silt (medium dense, wet) (native)				
		3	24								

Note: See Figure C-1 for explanation of symbols

LOG OF BORING RI-3

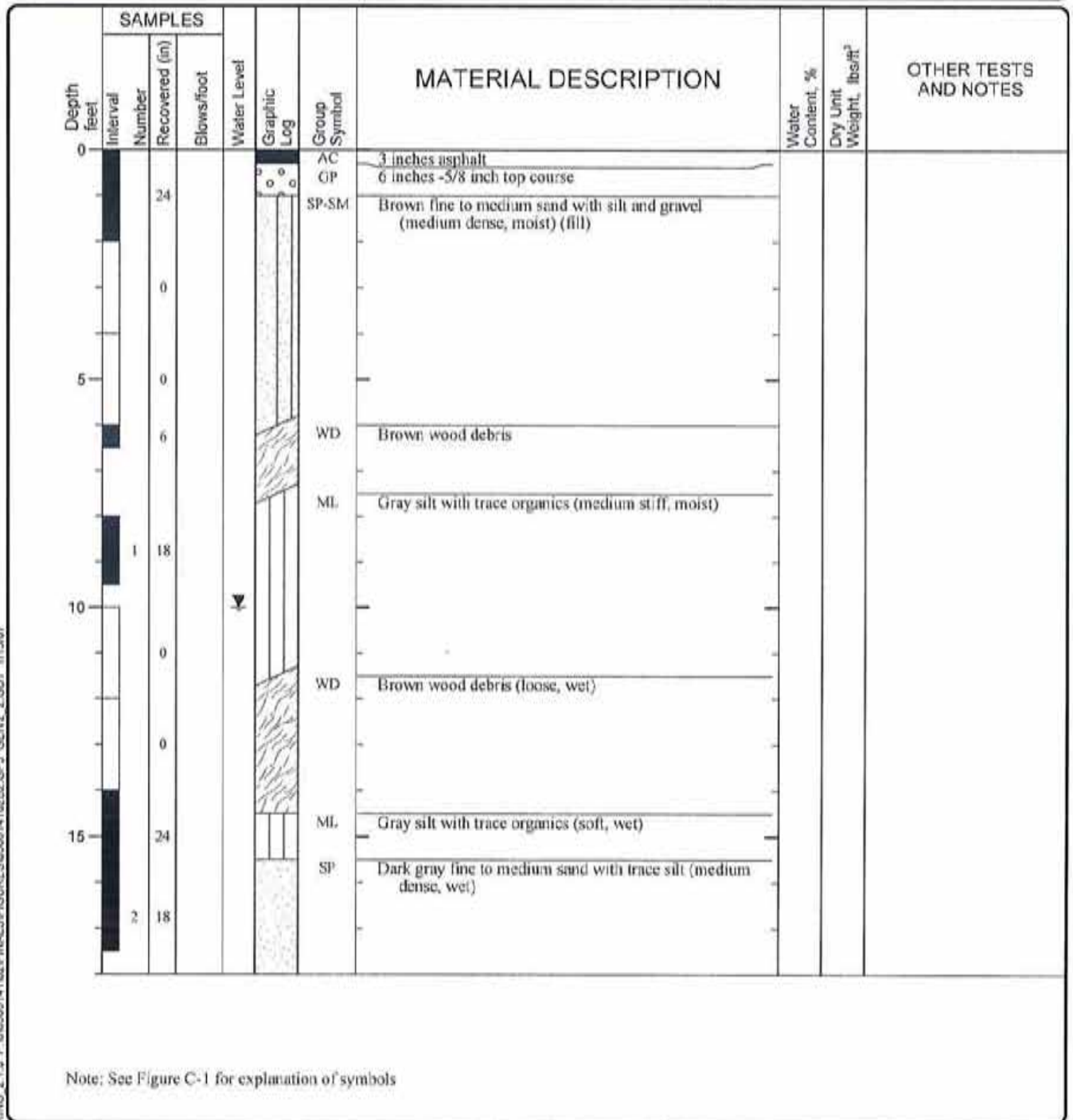


Project: BNSF Oil Pipeline Site
 Project Location: Tacoma, Washington
 Project Number: 0506-141-02

Figure: C-4
 Sheet 1 of 1

C:\05-141-02_GEI_GTBORING_2.1.0_P:\0506141\02\FINALS\FIGURES\050614102B2.GPJ_GEIVZ_2.GDT_1/15/07

Date(s) Drilled	03/15/04	Logged By	NER/DAR	Checked By	SLF
Drilling Contractor	Holt Drilling	Drilling Method	Stratprobe	Sampling Methods	Continuous
Auger Data	1.5 inch Standard SPT	Hammer Data		Drilling Equipment	Hydraulic & Percussion Drilling
Total Depth (ft)	18	Surface Elevation (ft)		Groundwater Level (ft. bgs)	10
Datum/System					



LOG OF BORING RI-4



Project: BNSF Oil Pipeline Site
 Project Location: Tacoma, Washington
 Project Number: 0506-141-02

Figure C-5
 Sheet 1 of 1

Date(s) Drilled	03/15/04	Logged By	NER/DAR	Checked By	SLF
Drilling Contractor	Holt Drilling	Drilling Method	Stratprobe	Sampling Methods	Continuous
Auger Data	1.5 inch Standard SPT	Hammer Data		Drilling Equipment	Hydraulic & Percussion Drilling
Total Depth (ft)	28	Surface Elevation (ft)		Groundwater Level (ft. bgs)	9
Datum/ System					

Depth feet	SAMPLES			Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, lbs/ft ³	OTHER TESTS AND NOTES
	Interval Number	Recovered (in)	Blows/foot							
0						GI*	4 inches - 1 1/4 inch base course (loose, moist) (fill)			
		24				SP-SM	Brown fine to medium sand with silt and gravel (medium dense, moist) (fill)			
		24				SP	Gray fine to medium sand with shells and trace silt (medium dense, moist) (fill)			
5		18					Gray fine to medium sand with trace silt and product globules (medium dense, moist)			
	1	6	6			WD	Brown wood debris (loose, moist)			
10		18					SAA with product globules (loose, wet)			
	2	24				SP	Gray fine to medium sand with trace silt (medium dense, wet)			
15		24					Gray fine to medium sand with trace silt and product globules (medium dense, wet)			
	3	24					Gray fine to medium sand with trace silt (medium dense, wet)			
	4	24					Gray fine to medium sand with trace silt and shells (medium dense, moist)			
20		24					Gray fine to medium sand with trace silt (medium dense, wet)			
		18					Gray fine to medium sand with trace silt and shells (medium dense, moist)			
25		24					Gray silt with sand (medium stiff, wet)			
	5	20				ML-SP	Gray fine sand with trace silt (medium dense, moist)			

Note: See Figure C-1 for explanation of symbols

LOG OF BORING RI-5



Project: BNSF Oil Pipeline Site
 Project Location: Tacoma, Washington
 Project Number: 0506-141-02

Figure: C-6
 Sheet 1 of 1

Date(s) Drilled	03/15/04	Logged By	NER/DAR	Checked By	SLF
Drilling Contractor	Holt Drilling	Drilling Method	Stratprobe	Sampling Methods	Continuous
Auger Data	1.5 inch Standard SPT	Hammer Data		Drilling Equipment	Hydraulic & Percussion Drilling
Total Depth (ft)	18	Surface Elevation (ft)		Groundwater Level (ft. bgs)	9
Datum/System					

Depth feet	SAMPLES			Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, lbs/ft ³	OTHER TESTS AND NOTES
	Interval Number	Recovered (in)	Blows/foot							
0						AC	4 inches asphalt			
		24				GP	6 inches of -5/8 inch top course (medium dense, moist) (fill)			
	1	24				SP-SM	Brown fine to medium sand with gravel, trace silt (medium dense, moist) (fill)			
							Grades with shells			
		18				SP	Gray fine sand with trace silt (medium dense, moist) (fill)			
5		6								
						WD	Brown wood debris (loose, moist)			
	2	18								
		6								
10										
		24								
						SP	Dark brown fine to medium sand with trace silt (medium dense, wet)			
15		24								
	3	24								

Note: See Figure C-1 for explanation of symbols

LOG OF BORING RI-6



Project: BNSF Oil Pipeline Site
 Project Location: Tacoma, Washington
 Project Number: 0506-141-02

Figure: C-7
 Sheet 1 of 1

Date(s) Drilled	03/18/04	Logged By	NER/DAR	Checked By	SLF
Drilling Contractor	Holt Drilling	Drilling Method	Stratprobe	Sampling Methods	Continuous
Auger Data	1.5 inch Standard SPT	Hammer Data		Drilling Equipment	Hydraulic & Percussion Drilling
Total Depth (ft)	18	Surface Elevation (ft)		Groundwater Level (ft. bgs)	9
Datum/ System					

Depth feet	SAMPLES			Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, lbs/ft ³	OTHER TESTS AND NOTES
	Interval Number	Recovered (in)	Blows/foot							
0						AC	Asphalt			
		24				GP	6 inches -5/8 inch top course (medium dense, moist) (fill)			
						SP-SM	Brown fine to medium sand with silt and gravel (medium dense, moist)			
		12					Becomes with cobbles (medium dense, moist) (fill)			
5		24								
	1	24				WD	Black wood debris with product globules (loose, moist)			
		6								
10		12					Brown wood debris with product globules (loose, wet)			
		24								
		12				ML	Gray silt with sand (loose, wet) (native?)			
15		12				SP	Gray fine to medium sand with trace silt (loose, wet) (native)			
	2	6								

Note: See Figure C-1 for explanation of symbols

LOG OF BORING RI-7



Project: BNSF Oil Pipeline Site
 Project Location: Tacoma, Washington
 Project Number: 0506-141-02

Figure: C-8
 Sheet 1 of 1

0506-141-02_GEI_GTBORING_2.1.0_P:05050514102\FINALS\FIGURES\050614102B2.GPJ_GEIV2_2.GDT_1/15/07

Date(s) Drilled	03/18/04	Logged By	NER/DAR	Checked By	SLF
Drilling Contractor	Holt Drilling	Drilling Method	Stratprobe	Sampling Methods	Continuous
Auger Data	1.5 inch Standard SPT	Hammer Data		Drilling Equipment	Hydraulic & Percussion Drilling
Total Depth (ft)	14	Surface Elevation (ft)		Groundwater Level (ft. bgs)	9
Datum/ System					

Depth feet	SAMPLES			Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, lbs/ft ³	OTHER TESTS AND NOTES
	Interval Number	Recovered (in)	Blows/foot							
0						AC	1 inch asphalt concrete			
						C	5 inches concrete pavement			
	1	24				GP	6 inches of -1-1/4 inch base course (medium dense, moist)			
						SP-SM	Brown fine to medium sand with gravel (medium dense, moist) (fill)			
			24							
5	2	24				SP	Brown fine to medium sand with trace silt (medium dense, moist)			
			18							
10	3	18					Brown fine to medium sand with trace silt and shell lenses (medium dense, wet)			
			18							
			24							

Note: See Figure C-1 for explanation of symbols

LOG OF BORING RI-25B



Project: BNSF Oil Pipeline Site
 Project Location: Tacoma, Washington
 Project Number: 0506-141-02

Figure: C-27
 Sheet 1 of 1

0506-141-02_GEI_GTBORING_2.1.0_P:\0506141\ORIGINALS\FIGURES\0506141\02B2.GPJ_GENV2_2.GDT_11/5/07

Date(s) Drilled	03/18/04	Logged By	NER/DAR	Checked By	SLF
Drilling Contractor	Holt Drilling	Drilling Method	Stratprobe	Sampling Methods	Continuous
Auger Data	1.5 inch Standard SPT	Hammer Data		Drilling Equipment	Hydraulic & Percussion Drilling
Total Depth (ft)	18	Surface Elevation (ft)		Groundwater Level (ft. bgs)	10
Datum/ System					

Depth feet	SAMPLES			Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, lbs/ft ³	OTHER TESTS AND NOTES
	Interval	Number	Recovered (in)							
0						SP-SM	Brown fine to medium sand with silt and occasional gravel (medium dense, moist) (fill)			
1		24				SP	Gray fine to medium sand with trace silt (medium dense, moist) (fill)			
2		18				SM	Gray silty fine sand (loose, moist) (fill)			
3		18				SP	Brown fine to medium sand with trace silt and occasional shells (loose, moist) (fill?)			
4		18				SM	Gray silty fine sand (loose, moist)			
5		24				M.L.	Gray silt with occasional wood debris (soft, moist)			
6		18				WD	Brown wood debris (loose, moist)			
7		6					Grades with product globules (loose, wet)			
8		6					Grades to brown wood debris (loose, wet)			
9		6				SP	Gray fine sand with trace silt (loose, wet)			
10										
11										
12										
13										
14										
15										
16										
17										
18		24								

Note: See Figure C-1 for explanation of symbols

LOG OF BORING RI-26



Project: BNSF Oil Pipeline Site
 Project Location: Tacoma, Washington
 Project Number: 0506-141-02

Figure: C-28
 Sheet 1 of 1

0506-141-02_GEI_GTBORING_2.1.0_P:\0506141\2\FINALS\FIGURES\050614102B2.GPJ_GEI\V2_Z.GDT_V15\07

Date(s) Drilled	03/19/04	Logged By	NER/DAR	Checked By	SLF
Drilling Contractor	Holt Drilling	Drilling Method	Stratprobe	Sampling Methods	Continuous
Auger Data	1.5 inch Standard SPT	Hammer Data		Drilling Equipment	Hydraulic & Percussion Drilling
Total Depth (ft)	18	Surface Elevation (ft)		Groundwater Level (ft. bgs)	10
Datum/System					

Depth feet	SAMPLES			Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, lbs/ft ³	OTHER TESTS AND NOTES
	Interval	Number	Recovered (in)							
0						AC	2 inches asphalt concrete			
		24				GP	4 inches of 1-1/4-inch base course (medium dense, moist) (fill)			
						SP-SM	Brown fine to medium sand with silt and gravel (medium dense, moist) (fill)			
	1	18				SP	Brown fine to medium sand with trace silt (medium dense, moist) (fill)			
5		18				ML	Gray silt (soil, moist)			
						SM	Gray silty fine to medium sand (loose, moist)			
						SP	Brown fine sand with trace silt (loose, moist)			
	2	18				WD	Wood debris with product globules (loose, moist)			
						SP	Brown fine to medium sand with trace silt (loose, moist)			
	3	18				WD	Wood debris with product viscous globules (loose, moist)			
10		6								
		18				SM	Gray silty fine sand (loose)			
						SP	Gray fine to medium sand with trace silt (loose, moist)			
15		18								
	4	24								

Note: See Figure C-1 for explanation of symbols

LOG OF BORING RI-31



Project: BNSF Oil Pipeline Site
 Project Location: Tacoma, Washington
 Project Number: 0506-141-02

Figure: C-33
 Sheet 1 of 1

D:\0506-141-02_GEI_GTBORING_2.1.D_P\0506141\ORIGINAL_S\FIGURES\050614102B0.GPJ_GEIV2_2.GDT 11:50T

Date(s) Drilled	03/19/04	Logged By	NER/DAR	Checked By	SLF
Drilling Contractor	Holt Drilling	Drilling Method	Stratprobe	Sampling Methods	Continuous
Auger Data	1.5 inch Standard SPT	Hammer Data		Drilling Equipment	Hydraulic & Percussion Drilling
Total Depth (ft)	16	Surface Elevation (ft)		Groundwater Level (ft. bgs)	10
Datum/System					

Depth feet	SAMPLES			Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, lbs/ft ³	OTHER TESTS AND NOTES
	Interval	Number	Recovered (in)							
0						AC	1.5 inches asphalt concrete			
						GP	4 inches of -1-1/4-inch base course (medium dense, moist)			
		24				SP-SM	Brown fine to medium sand with silt and gravel (medium dense, moist) (fill)			
						SP	Brown fine sand with trace silt			
1		18				ML	Brown silt with wood debris (soft, moist) (fill)			
5		18				WD	Black wood debris with sand (loose, moist)			
						ML	Gray silt with occasional wood debris (soft, moist)			
	2	18				WD	Brown wood debris (loose, moist)			
						ML	Gray silt with wood debris (soft, moist)			
		18				WD	Brown wood debris with product globules (loose, moist)			
10						SP	Gray fine to medium sand with trace silt (loose, wet)			
		18								
	3	6								
						ML	Gray silt with trace organics (soft, wet)			
15		4	24			SP	Gray fine to medium sand with trace silt (loose, wet)			

Note: See Figure C-1 for explanation of symbols

LOG OF BORING RI-33



Project: BNSF Oil Pipeline Site
 Project Location: Tacoma, Washington
 Project Number: 0506-141-02

Figure: C-35
 Sheet 1 of 1

0506-141-02 GEI GTEORING 2.1.0 P:\0506-141\02\FINALS\FIGURES\050614102B2.GPJ GENV2.2.GDT 1/15/07

Date(s) Drilled	03/19/04	Logged By	NER/DAR	Checked By	SLF
Drilling Contractor	Holt Drilling	Drilling Method	Stratprobe	Sampling Methods	Continuous
Auger Data	1.5 inch Standard SPT	Hammer Data		Drilling Equipment	Hydraulic & Percussion Drilling
Total Depth (ft)	14	Surface Elevation (ft)		Groundwater Level (ft. bgs)	10
Datum/ System					

Depth feet	SAMPLES			Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, lbs/ft ³	OTHER TESTS AND NOTES
	Interval	Number	Recovered (in)							
0						AC	1.5 inches asphalt concrete			
						GP	4 inches of -1-1/4-inch base course (medium dense, moist)			
		24				SP-SM	Brown fine to medium sand with silt and gravel (medium dense, moist) (fill)			
						SM	Brown silty fine sand (loose, moist)			
						ML	Brown silt with trace organics (soft, moist)			
						WD	Black wood debris (loose, moist)			
	1	18								
							Brown wood debris (loose, moist)			
5		12								
							Brown wood debris with product globules (loose, moist)			
	2	12								
		0								
10						SM	Gray silty fine sand (loose, moist)			
	3	12								
		12								

Note: See Figure C-1 for explanation of symbols

LOG OF BORING RI-34



Project: BNSF Oil Pipeline Site
 Project Location: Tacoma, Washington
 Project Number: 0506-141-02

Figure: C-36
 Sheet 1 of 1

Date(s) Drilled	03/19/04	Logged By	NER/DAR	Checked By	SLF
Drilling Contractor	Holt Drilling	Drilling Method	Stratprobe	Sampling Methods	Continuous
Auger Data	1.5 inch Standard SPT	Hammer Data		Drilling Equipment	Hydraulic & Percussion Drilling
Total Depth (ft)	20	Surface Elevation (ft)		Groundwater Level (ft. bgs)	10
Datum/ System					

Depth feet	SAMPLES				Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, lbs/ft ³	OTHER TESTS AND NOTES
	Interval	Number	Recovered (in)	Blows/foot							
0							AC GP SP-SM	5 inches asphalt concrete 5 inches of -1-1/4-inch base course (medium dense, moist) Dark brown fine to medium sand with silt and gravel (medium dense, moist) (fill)			
1		0					SM	Gray silty fine sand (loose, moist)			
5		18					WD	Wood debris (loose, moist)			
2		12									
3		6									
10		6									
15		0					SM	Gray silty fine sand (loose, wet)			
		18									
20		18									

Note: See Figure C-1 for explanation of symbols

LOG OF BORING RI-35



Project: BNSF Oil Pipeline Site
 Project Location: Tacoma, Washington
 Project Number: 0506-141-02

Figure: C-37
 Sheet 1 of 1


0506-141-02_GEI_GTISSORING_2.1.D_P_00050614102FINALFIGURES050614102B2.GPJ_GENVZ_2.GDT_1/15/07

Date(s) Drilled	03/19/04	Logged By	NER/DAR	Checked By	SLF
Drilling Contractor	Holt Drilling	Drilling Method	Stratprobe	Sampling Methods	Continuous
Auger Data	1.5 inch Standard SPT	Hammer Data		Drilling Equipment	Hydraulic & Percussion Drilling
Total Depth (ft)	18	Surface Elevation (ft)		Groundwater Level (ft. bgs)	8
Datum/System					

Depth feet	SAMPLES			Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, lbs/ft ³	OTHER TESTS AND NOTES
	Interval	Number	Recovered (in)							
0						AC GP SP	1 inch asphalt concrete 5 inches of 1-1/4-inch base course (medium dense, moist) (fill) Brown fine to medium sand with trace silt and shells (medium dense, moist) (fill)			
1		18								
5		24								
10		24								
15		24				ML	Gray silt (medium stiff, wet)			

Note: See Figure C-1 for explanation of symbols

0506-141-02_GEI_GTECORING 2.1.0 P:\0506141\02\FINALS\FIGURES\050614102B2.GPJ_GEV2_2.GDT_1/15/07

LOG OF BORING RI-36		
	Project:	BNSF Oil Pipeline Site
	Project Location:	Tacoma, Washington
	Project Number:	0506-141-02
		Figure: C-38 Sheet 1 of 1

Date(s) Drilled	03/20/04	Logged By	NER/DAR	Checked By	SLF
Drilling Contractor	Holt Drilling	Drilling Method	Stratprobe	Sampling Methods	Continuous
Auger Data	1.5 inch Standard SPT	Hammer Data		Drilling Equipment	Hydraulic & Percussion Drilling
Total Depth (ft)	18	Surface Elevation (ft)		Groundwater Level (ft. bgs)	10
Datum/System					

Depth feet	SAMPLES			Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, lbs/ft ³	OTHER TESTS AND NOTES
	Interval	Number	Recovered (in)							
0						AC	1.5 inches asphalt concrete			
1		24				OP SP-SM	4 inches of -5/8-inch top course (medium dense, moist) (fill) Brown to dark brown fine to medium sand with trace silt and gravel (medium dense, moist) (fill)			
2		18								
5		24				SM	Gray silty fine sand (medium dense, moist)			
						WD	Brown wood debris (loose, moist)			
		12								
4		12								
10										
		6					Grades to with produce globules (loose, wet)			
						ML	Gray silt (soft, wet)			
		12								
15		12								
						SM	Gray silty fine sand (loose, wet)			
		6								

Note: See Figure C-1 for explanation of symbols

LOG OF BORING RI-40



Project: BNSF Oil Pipeline Site
 Project Location: Tacoma, Washington
 Project Number: 0506-141-02

Figure: C-42
 Sheet 1 of 1

0506-141-02 GEOENGINEERS 2.1.0 P:\0506\0514102\PIPLS\FIGURES\050614102B2.CPJ_GEV2.2.GDT 1/15/07

Date(s) Drilled	03/20/04	Logged By	NER/DAR	Checked By	SLF
Drilling Contractor	Holt Drilling	Drilling Method	Stratprobe	Sampling Methods	Continuous
Auger Data	1.5 inch Standard SPT	Hammer Data		Drilling Equipment	Hydraulic & Percussion Drilling
Total Depth (ft)	20	Surface Elevation (ft)		Groundwater Level (ft. bgs)	B
Datum/System					

Depth feet	SAMPLES				Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, lbs/ft ³	OTHER TESTS AND NOTES
	Interval	Number	Recovered (in)	Blows/foot							
0							AC GP SP-SM	1.5 inches asphalt concrete 4 inches of -5/8-inch top course (medium dense, moist) (fill) Brown fine to medium sand with silt and gravel (medium dense, moist) (fill)			
6	1	12									
	2	6									
10							SM	Brown fine to medium sand with silt, gravel and product globules (loose, wet) Gray silty fine sand (loose, wet) (native?)			
	3	3									
15							SP	Gray fine sand with trace silt (loose, wet)			
	4	12									
	5	12						Gray fine sand with trace silt and shells (loose, wet)			
20											

Note: See Figure C-1 for explanation of symbols

0506-141-02_GEI_GTDORING_2.1.0_P:01020014102FINAL\FIGURES\0506-141-02R2.GPJ_GENV2_2.GDT_1/15/07

LOG OF BORING RI-41



Project: BNSF Oil Pipeline Site
 Project Location: Tacoma, Washington
 Project Number: 0506-141-02

Figure: C-43
 Sheet 1 of 1

Date(s) Drilled	03/20/04	Logged By	NER/DAR	Checked By	SLF
Drilling Contractor	Holt Drilling	Drilling Method	Stratprobe	Sampling Methods	Continuous
Auger Data	1.5 inch Standard SPT	Hammer Data		Drilling Equipment	Hydraulic & Percussion Drilling
Total Depth (ft)	16	Surface Elevation (ft)		Groundwater Level (ft. bgs)	8
Datum/ System					

Depth feet	SAMPLES			Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, lbs/ft ³	OTHER TESTS AND NOTES
	Interval	Number	Recovered (in)							
0						AC	1.5 inches asphalt concrete			
		24				GP	6 inches of -1/4-inch base course (medium dense, moist) (fill)			
						SP-SM	Brown fine to medium sand with silt and gravel (medium dense, moist) (fill)			
						SP	Brown fine sand with trace silt (medium dense, moist)			
		24				ML	Gray-brown silt with wood debris (medium dense, moist)			
						SP	Gray-brown silty fine sand (medium dense, moist)			
5	1	18					Gray-brown silty fine to medium sand with wood debris (loose, moist)			
						WD	Orange wood debris (loose, moist)			
		6					Grades to loose, wet			
	2	10					Gray fine sand with trace silt (loose, wet)			
							Grades to medium dense, wet			
	3	18					Grades to loose, wet			
15		18								

Note: See Figure C-1 for explanation of symbols

LOG OF BORING RI-42



Project: BNSF Oil Pipeline Site
 Project Location: Tacoma, Washington
 Project Number: 0506-141-02

Figure: C-44
 Sheet 1 of 1

0506-141-02_GEL_GTBORINGS_2.1.0_P:\0506\14102\FINAL\FIGURES\050614102B2.GPJ_GEV2_2.GDT 01/5/07

Date(s) Drilled	03/20/04	Logged By	NER/DAR	Checked By	SLF
Drilling Contractor	Holt Drilling	Drilling Method	Stratprobe	Sampling Methods	Continuous
Auger Data	1.5 inch Standard SPT	Hammer Data		Drilling Equipment	Hydraulic & Percussion Drilling
Total Depth (ft)	18	Surface Elevation (ft)		Groundwater Level (ft. bgs)	8
Datum/ System					

Depth feet	SAMPLES			Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, lbs/ft ³	OTHER TESTS AND NOTES
	Interval	Number	Recovered (in)							
0						AC	1 inch asphalt concrete			
						GP	5 inches of 1-1/4-inch base course (medium dense, moist) (fill)			
	1	18				SP-SM	Brown fine to medium sand with silt and gravel (medium dense, moist) (fill)			
						SP	Brown-gray fine sand with trace silt (medium dense, moist)			
						ML	Gray silt (soft, moist)			
						WD	Brown wood debris (loose, moist)			
5	2	12					Grades to loose, moist			
						SM	Gray silty fine sand (loose, wet)			
							Grades to loose, wet			
10							Grades to very loose, wet			
							Grades to loose, wet			
							Grades to very loose, wet			
15	3	18				SP	Gray fine sand with trace silt and occasional wood debris (loose, wet)			
							Grades to very loose, wet			

Note: See Figure C-1 for explanation of symbols

LOG OF BORING RI-43



Project: BNSF Oil Pipeline Site
 Project Location: Tacoma, Washington
 Project Number: 0506-141-02

Figure: C-45
 Sheet 1 of 1

0506-141-02_GEI_GTBORING_2.1.0_P40050614102GINALSPFIGURES0614102R2.GPJ_GEINW_2.GD01_111507

Date(s) Drilled	03/22/04	Logged By	NER/DAR	Checked By	SLF
Drilling Contractor	Holt Drilling	Drilling Method	Stratprobe	Sampling Methods	Continuous
Auger Data	1.5 inch Standard SPT	Hammer Data		Drilling Equipment	Hydraulic & Percussion Drilling
Total Depth (ft)	20	Surface Elevation (ft)		Groundwater Level (ft. bgs)	8
Datum/System					

Depth feet	SAMPLES				Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, lbs/ft ³	OTHER TESTS AND NOTES
	Interval	Number	Recovered (in)	Blows/foot							
0							SP-SM	Brown fine to medium sand with silt and gravel (medium dense, moist) (fill)			
12											
12							SP	Gray-brown fine to coarse sand with trace silt and gravel (medium dense, moist) (fill)			
6							WD	Brown wood debris (loose, moist)			
6											
10	1	6						Grades with product globules (loose, wet)			
10											
15	2	0									
15							SP	Dark gray fine to medium sand with trace silt (medium dense, wet)			
15											
20	3	18									

Note: See Figure C-1 for explanation of symbols

LOG OF BORING RI-44



Project: BNSF Oil Pipeline Site
 Project Location: Tacoma, Washington
 Project Number: 0506-141-02

Figure: C-48
 Sheet 1 of 1

0506-141-02_GEI_GTBORING_2.0_P:\0506141\02\FINAL\SP\FIGURE\SUBS\14102B2.GPJ_GEI\2_2.GDT 1/15/07

Date(s) Drilled	03/22/04	Logged By	NER/DAR	Checked By	SLF
Drilling Contractor	Holt Drilling	Drilling Method	Stratprobe	Sampling Methods	Continuous
Auger Data	1.5 inch Standard SPT	Hammer Data		Drilling Equipment	Hydraulic & Percussion Drilling
Total Depth (ft)	18	Surface Elevation (ft)		Groundwater Level (ft. bgs)	10
Datum/System					

Depth feet	SAMPLES			Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, lbs/ft ³	OTHER TESTS AND NOTES
	Interval	Number	Recovered (in)							
0						AC	2 inches asphalt concrete			
						C	6 inches concrete pavement			
		24				GP	8 inches -1-1/4-inch base course (very dense, moist) (fill)			
						SP	Brown fine to medium sand with trace silt (medium dense, moist) (fill)			
						ML	Gray silt (medium stiff, moist) (fill?)			
		6								
						WD	Black wood debris with sand (loose, moist)			
5	1	12					Becomes brown (loose, moist)			
		6								
		2								
10										
		2	18			SP	Gray fine sand with trace silt and wood debris (loose, wet)			
			18				Gray fine sand with trace silt (loose, wet)			
15										
		3	18							
		4	6							

Note: See Figure C-1 for explanation of symbols

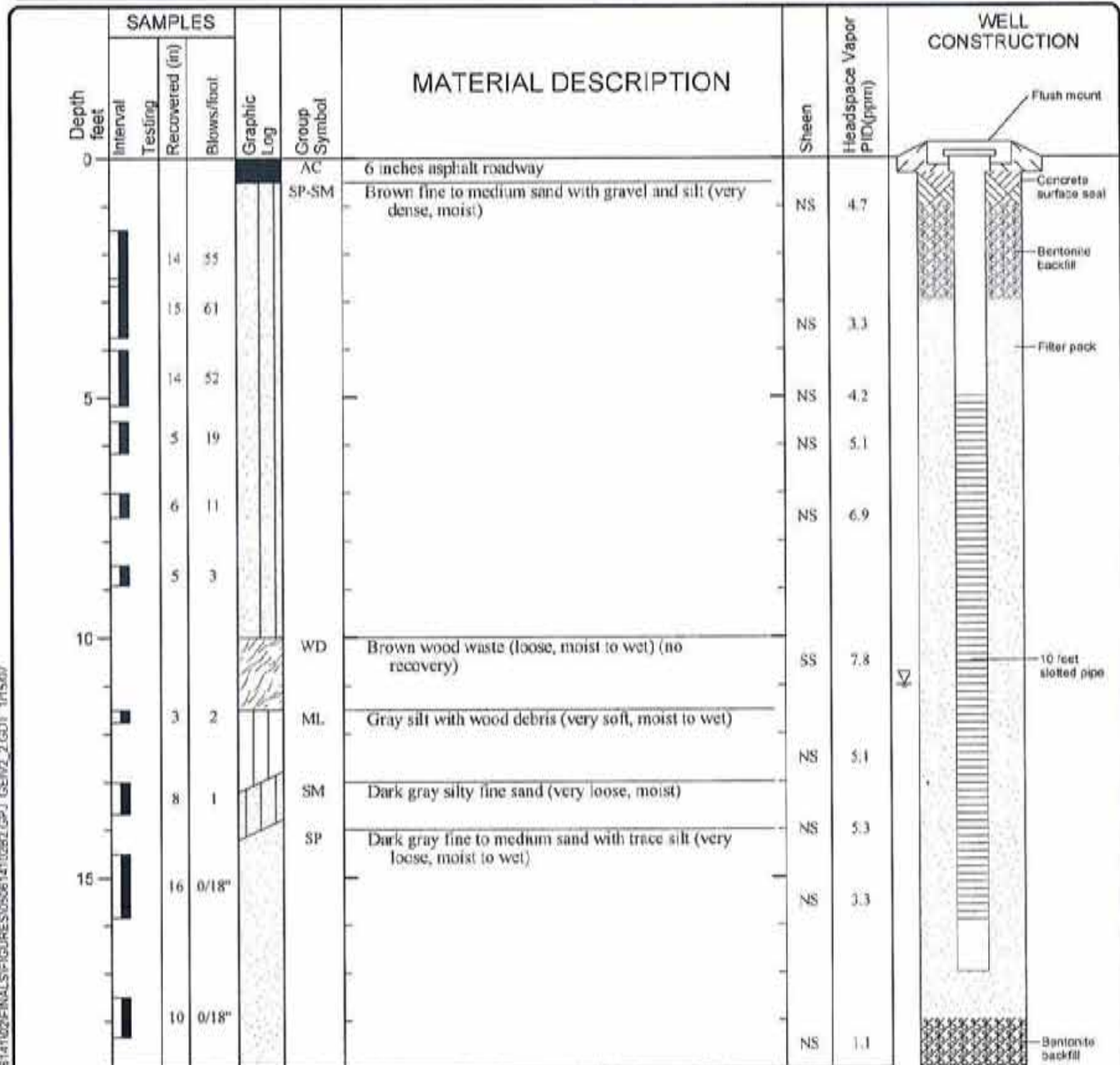
LOG OF BORING RI-47



Project: BNSF Oil Pipeline Site
 Project Location: Tacoma, Washington
 Project Number: 0506-141-02

Figure: C-49
 Sheet 1 of 1

Date(s) Drilled	04/13/04	Logged By	NER	Checked By	DAR
Drilling Contractor	Holt Drilling	Drilling Method	HSA	Sampling Methods	Continuous (1.5-inch-split barrel)
Total Boring Depth (ft)	19	Hammer Data	140 (lb) hammer/ 30 (in) drop	Drilling Equipment	B-59 Truck Mount
Well Depth (ft)	17	Top of Well Elevation (ft)	18.19	Groundwater Elevation (ft)	7.19
System/ Datum					



Note: See Figure C-1 for explanation of symbols

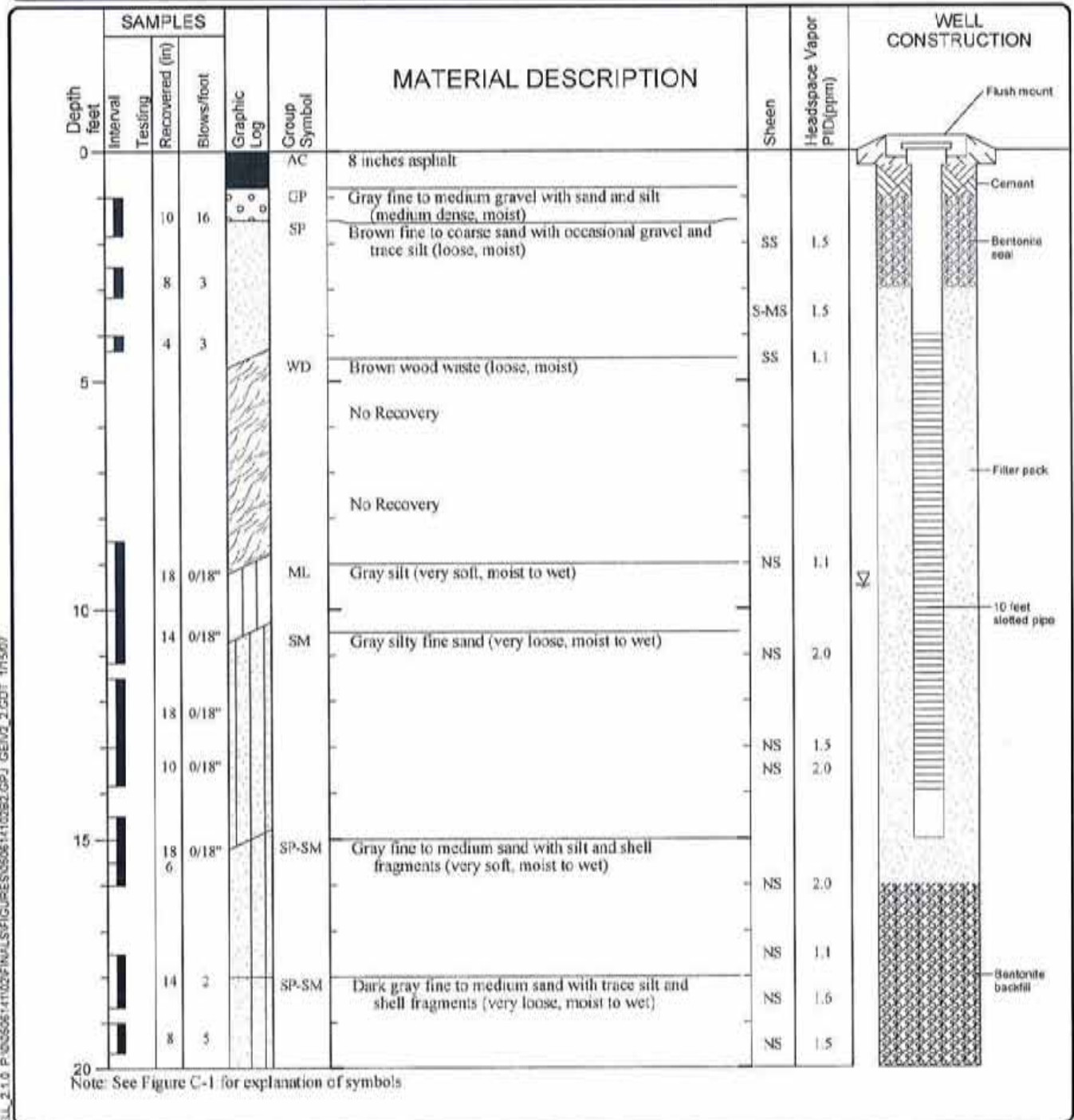
LOG OF MONITORING WELL MW-1



Project: BNSF Oil Pipeline Site
 Project Location: Tacoma, Washington
 Project Number: 0506-141-02

Figure: C-51
 Sheet 1 of 1

Date(s) Drilled	04/13/04	Logged By	NER	Checked By	DAR
Drilling Contractor	Holt Drilling	Drilling Method	HSA	Sampling Methods	Continuous (1.5-inch-split barrel)
Total Boring Depth (ft)	20	Hammer Data	140 (lb) hammer/ 30 (in) drop	Drilling Equipment	B-59 Truck Mount
Well Depth (ft)	15	Top of Well Elevation (ft)	14.27	Groundwater Elevation (ft)	4.77
System/ Datum					



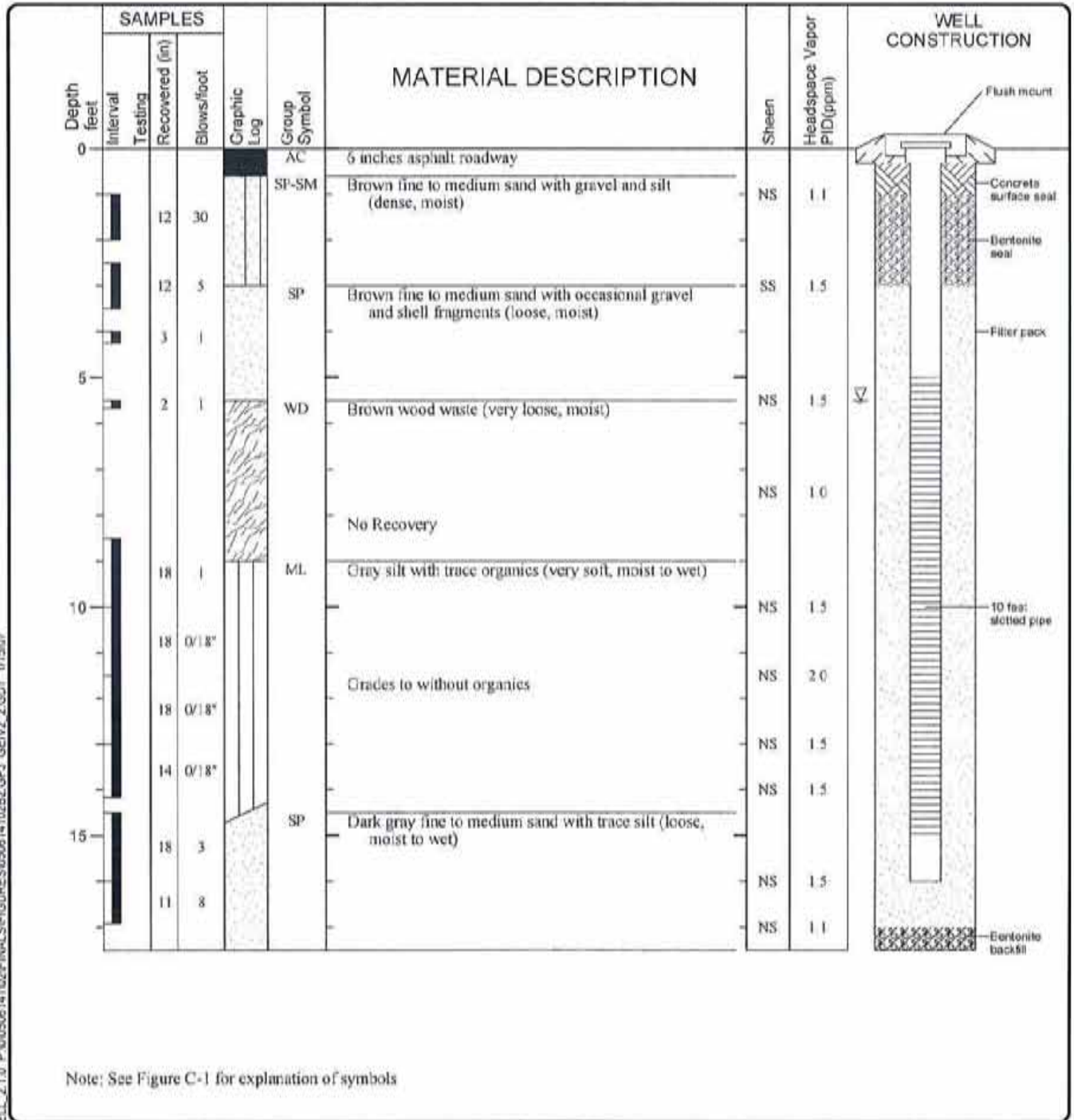
LOG OF MONITORING WELL MW-2



Project: BNSF Oil Pipeline Site
 Project Location: Tacoma, Washington
 Project Number: 0506-141-02

Figure: C-52
 Sheet 1 of 1

Date(s) Drilled	04/13/04	Logged By	NER	Checked By	DAR
Drilling Contractor	Holt Drilling	Drilling Method	HSA	Sampling Methods	Continuous (1.5-inch-split barrel)
Total Boring Depth (ft)	17.5	Hammer Data	140 (lb) hammer/ 30 (in) drop	Drilling Equipment	B-59 Truck Mount
Well Depth (ft)	16	Top of Well Elevation (ft)	14.57	Groundwater Elevation (ft)	9.07
System/ Datum					



LOG OF MONITORING WELL MW-3

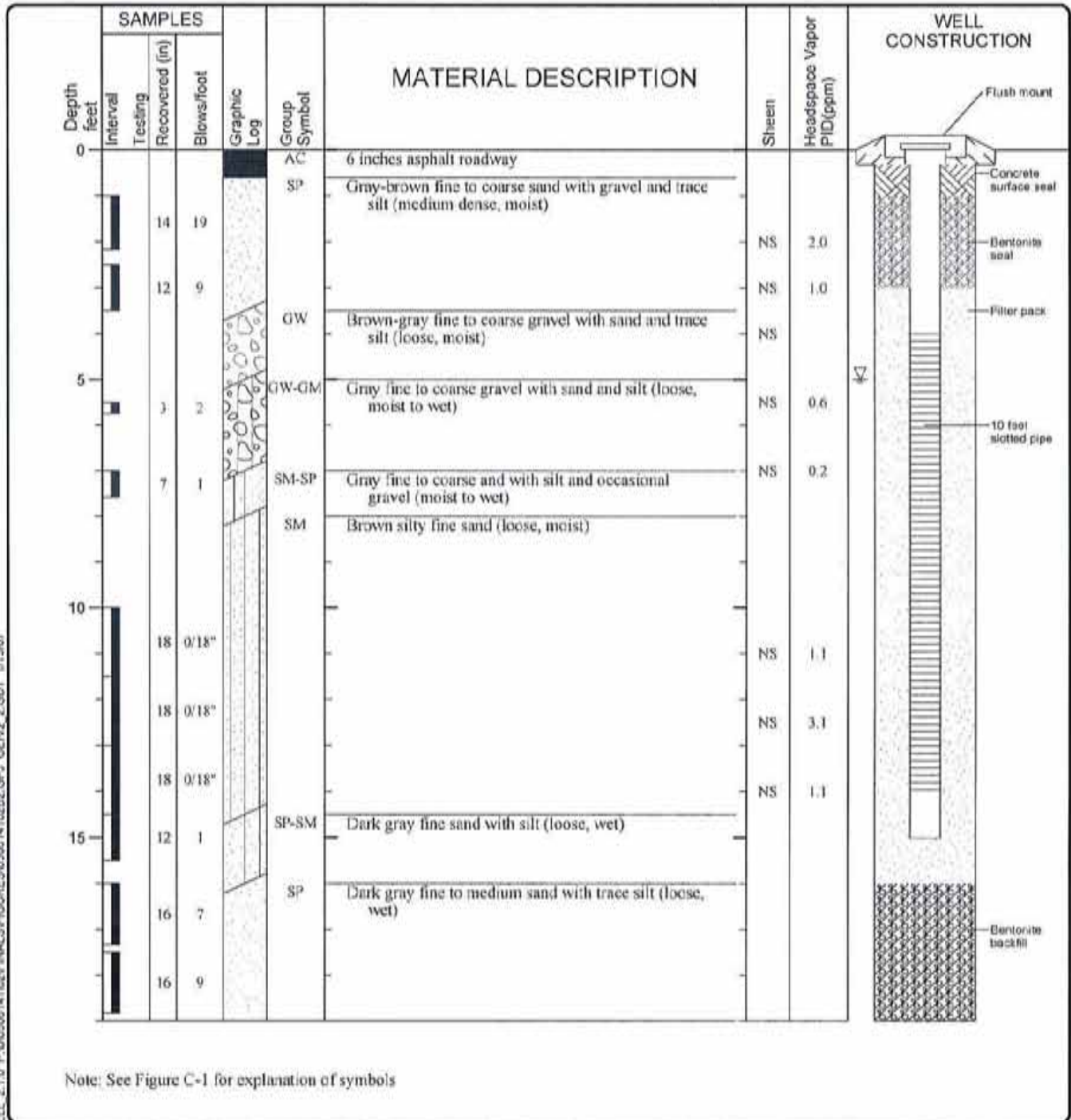


Project: BNSF Oil Pipeline Site
 Project Location: Tacoma, Washington
 Project Number: 0506-141-02

Figure: C-53
 Sheet 1 of 1

0506-141-02_GEI_ENVWELL_2.1.0_P:\00506141\02\FINALS\FIGURES\050614102B2.GPJ_GEIV2_2.GDT 1/15/07

Date(s) Drilled	04/13/04	Logged By	NER	Checked By	DAR
Drilling Contractor	Holt Drilling	Drilling Method	HSA	Sampling Methods	Continuous (1.5-inch-split barrel)
Total Boring Depth (ft)	19	Hammer Data	140 (lb) hammer/ 30 (in) drop	Drilling Equipment	B-59 Truck Mount
Well Depth (ft)	15	Top of Well Elevation (ft)	15.08	Groundwater Elevation (ft)	10.08
System/ Datum					



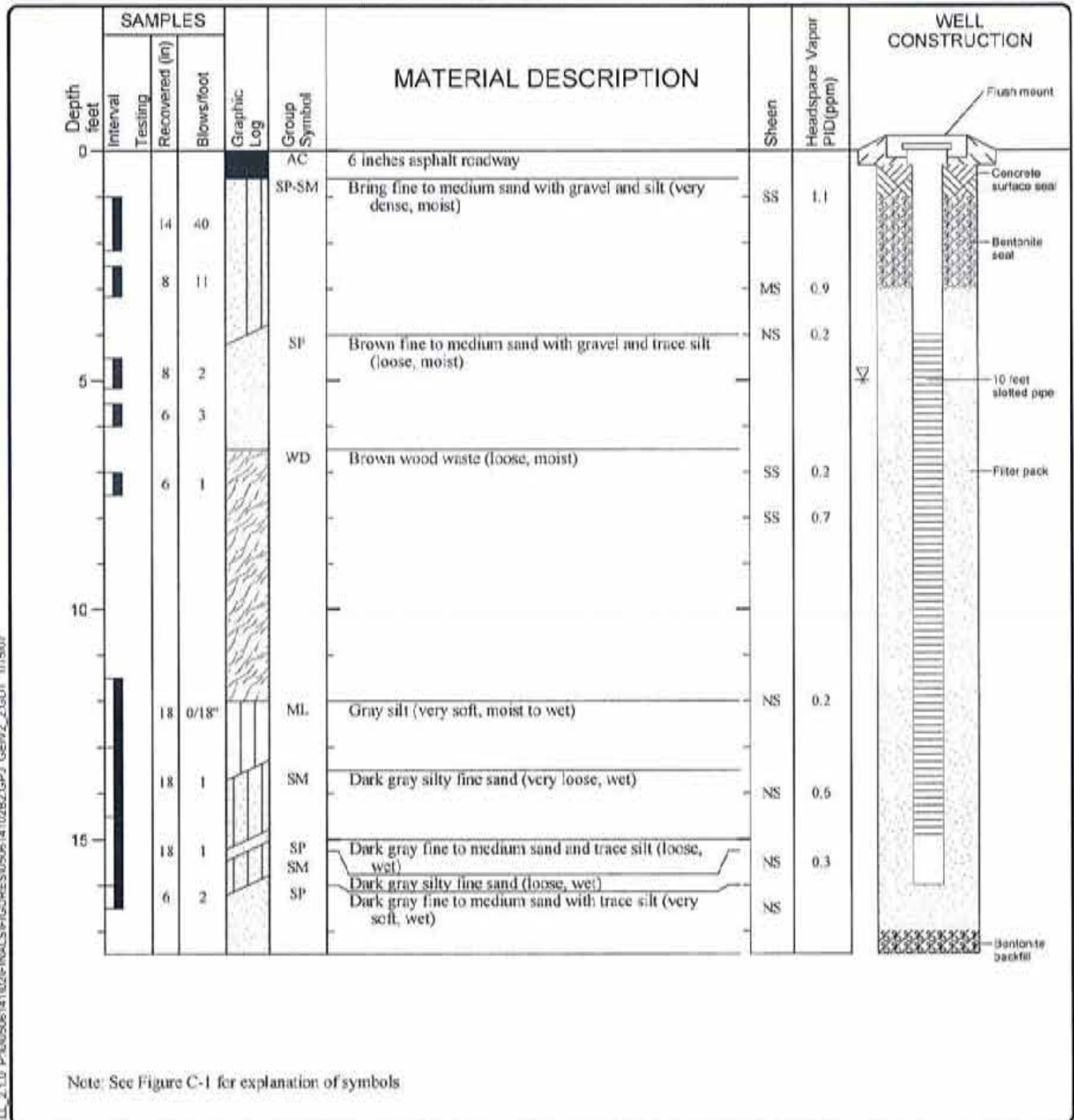
LOG OF MONITORING WELL MW-4




Project: BNSF Oil Pipeline Site
 Project Location: Tacoma, Washington
 Project Number: 0506-141-02

Figure: C-54
 Sheet 1 of 1

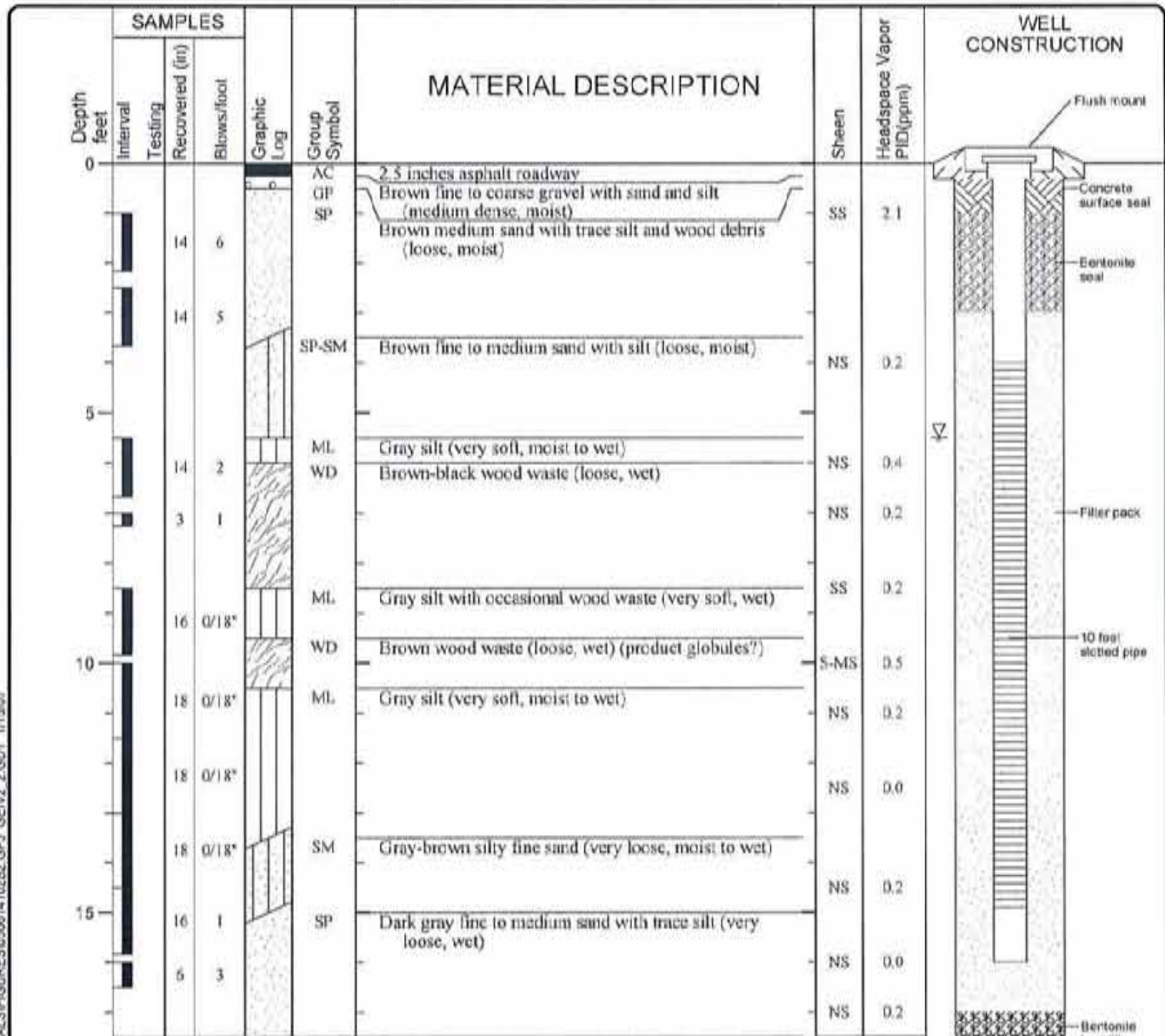
Date(s) Drilled	04/13/04	Logged By	NER	Checked By	DAR
Drilling Contractor	Holt Drilling	Drilling Method	HSA	Sampling Methods	Continuous (1.5-inch-split barrel)
Total Boring Depth (ft)	17.5	Hammer Data	140 (lb) hammer/ 30 (in) drop	Drilling Equipment	B-59 Truck Mount
Well Depth (ft)	16	Top of Well Elevation (ft)	15.47	Groundwater Elevation (ft)	10.47
System/ Datum					



0506-141-02_GEO ENGWELL 2.1.0_P:0050614102FINALSPFIGURES050614102BQ.GPJ_GEPV2_2.GDT 1/15/07

LOG OF MONITORING WELL MW-5		
	Project:	BNSF Oil Pipeline Site
	Project Location:	Tacoma, Washington
	Project Number:	0506-141-02
		Figure: C-55 Sheet 1 of 1

Date(s) Drilled	04/13/04	Logged By	NER	Checked By	DAR
Drilling Contractor	Holt Drilling	Drilling Method	HSA	Sampling Methods	Continuous (1.5-inch-split barrel)
Total Boring Depth (ft)	17.5	Hammer Data	140 (lb) hammer/ 30 (in) drop	Drilling Equipment	B-59 Truck Mount
Well Depth (ft)	16	Top of Well Elevation (ft)	15.38	Groundwater Elevation (ft)	9.88
System/ Datum					



Note: See Figure C-1 for explanation of symbols

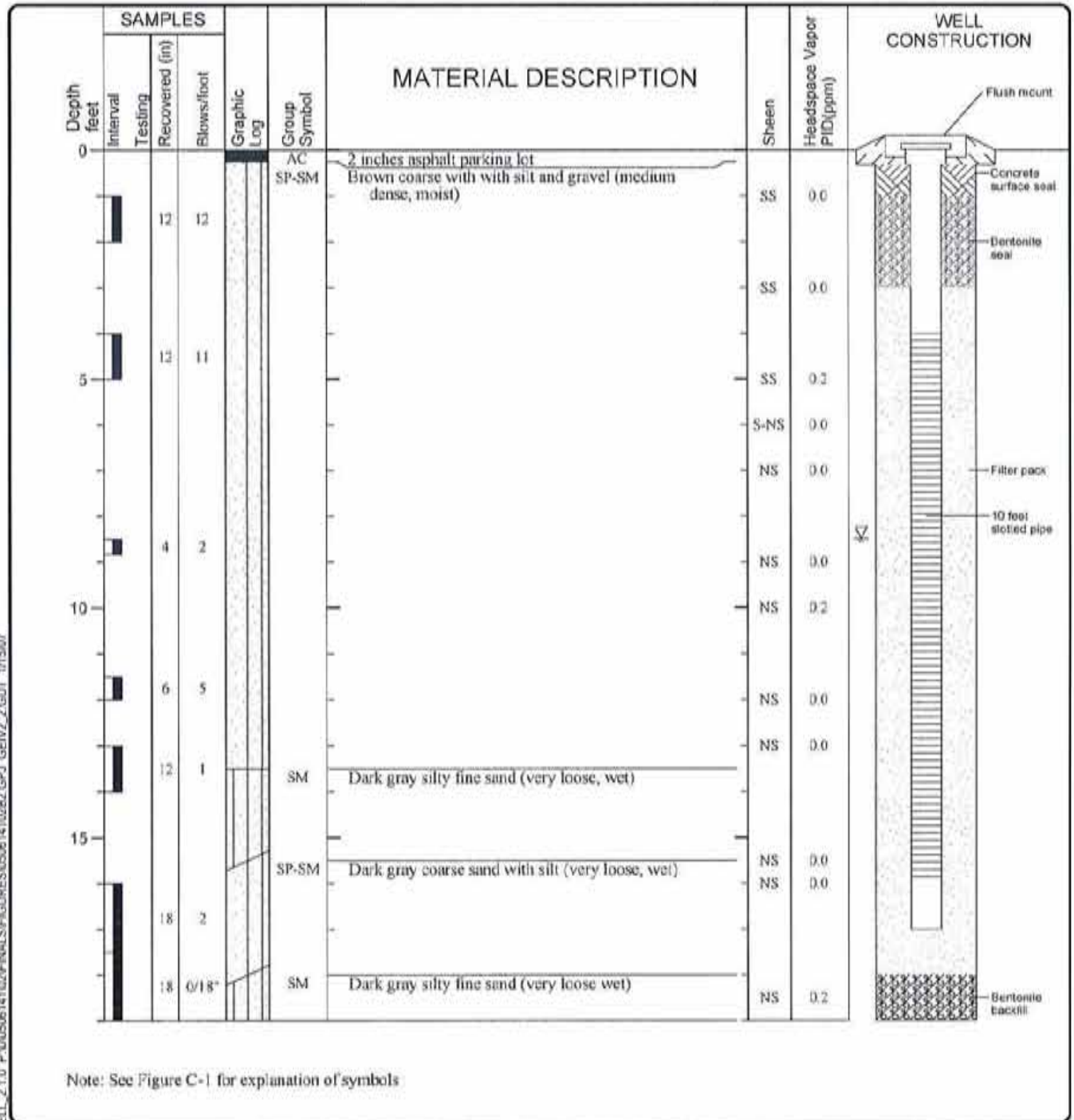
LOG OF MONITORING WELL MW-6



Project: BNSF Oil Pipeline Site
 Project Location: Tacoma, Washington
 Project Number: 0506-141-02

Figure: C-56
 Sheet 1 of 1

Date(s) Drilled	04/13/04	Logged By	NER	Checked By	DAR
Drilling Contractor	Holt Drilling	Drilling Method	HSA	Sampling Methods	Continuous (1.5-inch-split barre)
Total Boring Depth (ft)	19	Hammer Data	140 (lb) hammer/ 30 (in) drop	Drilling Equipment	B-59 Truck Mount
Well Depth (ft)	17	Top of Well Elevation (ft)	18.04	Groundwater Elevation (ft)	9.54
System/ Datum					



LOG OF MONITORING WELL MW-7

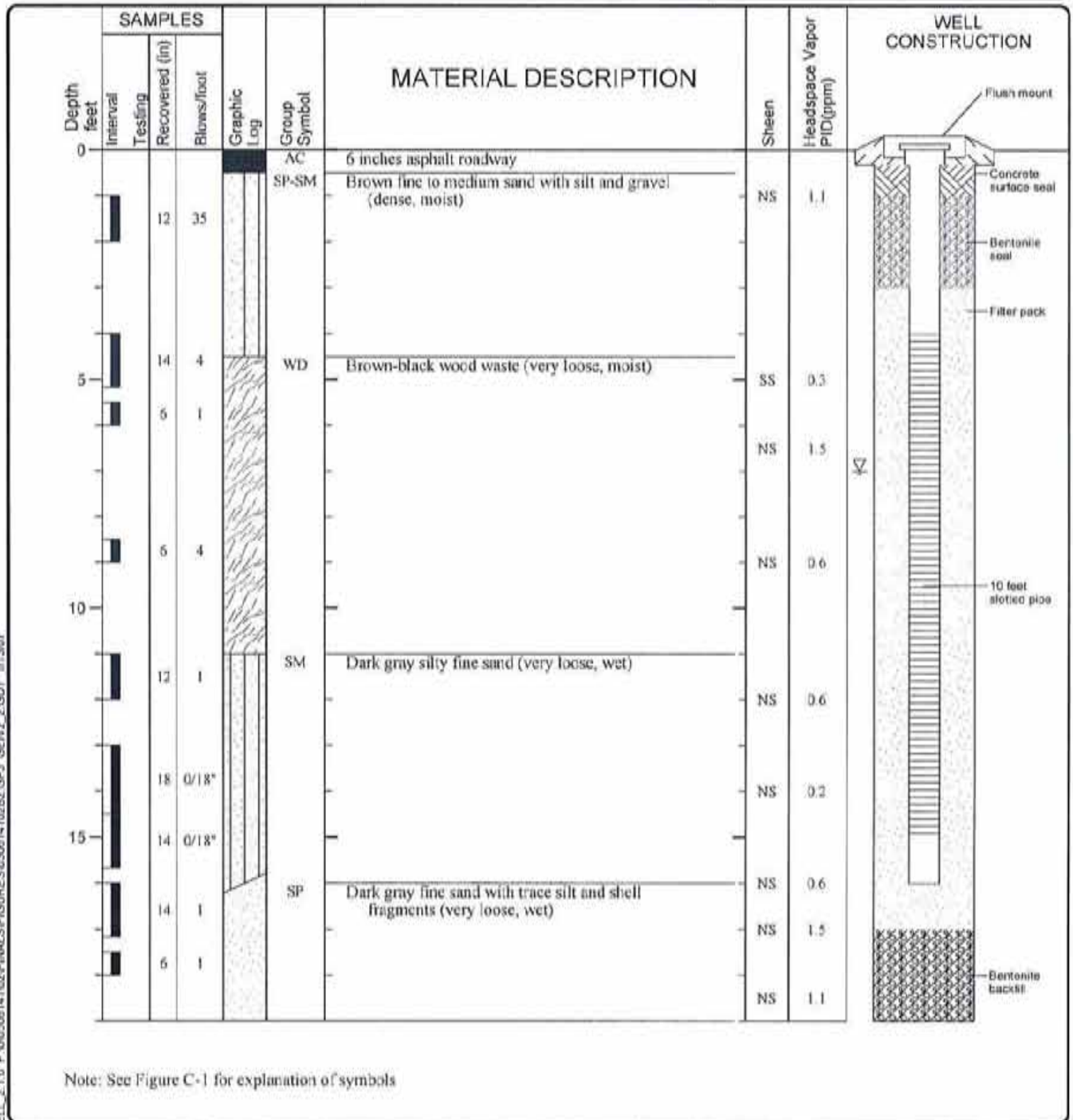


Project: BNSF Oil Pipeline Site
 Project Location: Tacoma, Washington
 Project Number: 0506-141-02

Figure: C-57
 Sheet 1 of 1

0506-141-02_GEO ENVWELL_2.1.0_P:\0506141\02\FINALS\FIGURES\0506141\02BZ.GPJ_GENV2_2.GDT 1/13/07

Date(s) Drilled	04/13/04	Logged By	NER	Checked By	DAR
Drilling Contractor	Holt Drilling	Drilling Method	HSA	Sampling Methods	Continuous (1.5-inch-split barrel)
Total Boring Depth (ft)	19	Hammer Data	140 (lb) hammer/ 30 (in) drop	Drilling Equipment	B-59 Truck Mount
Well Depth (ft)	15	Top of Well Elevation (ft)	15.97	Groundwater Elevation (ft)	8.97
System/ Datum					



0506-141-02_GEOENGINEERS_2.1.0_FINALS\FIGURES\050614102BZ.GPJ_GEMV2_2.GOT_1/1/507

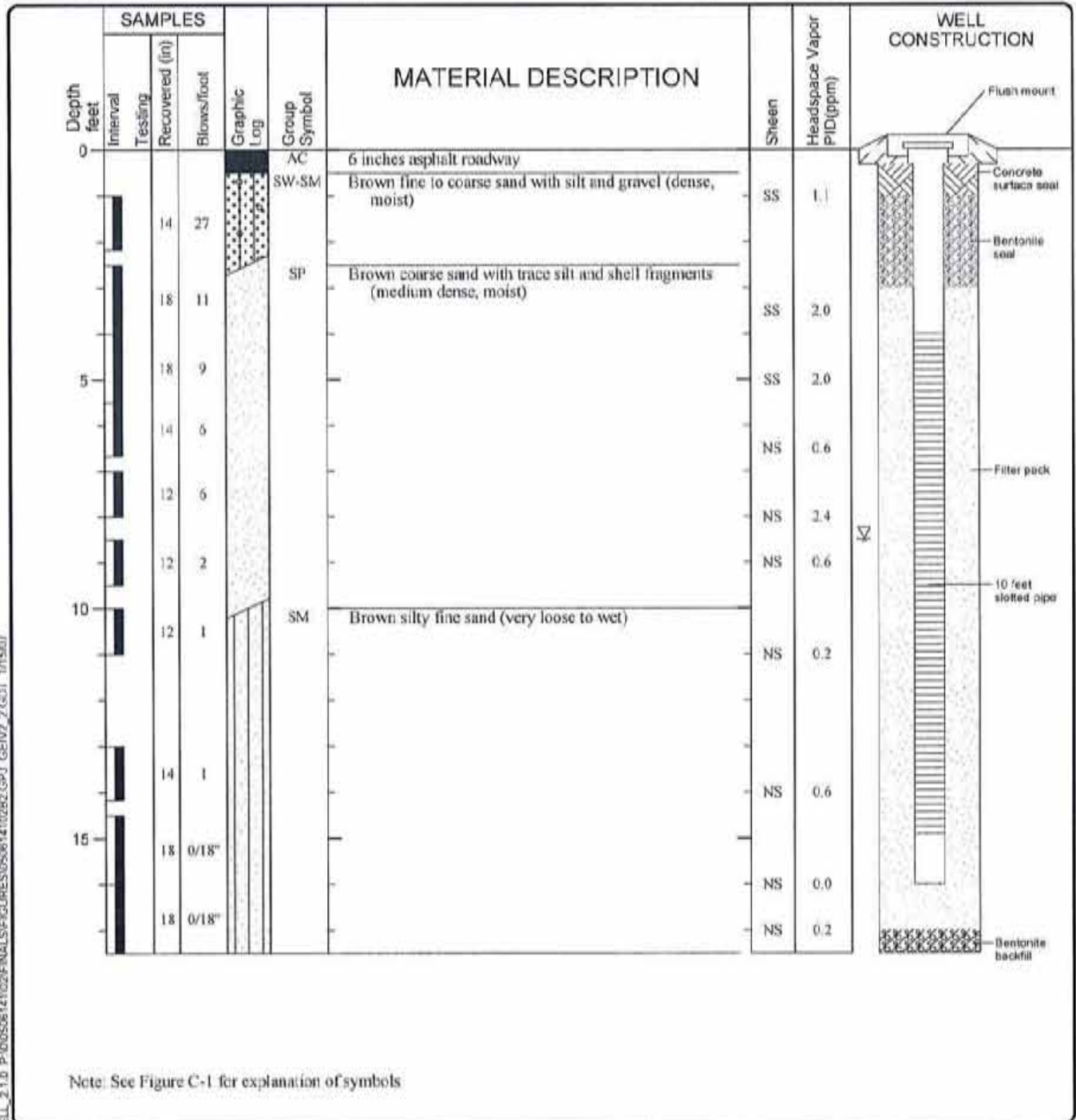
LOG OF MONITORING WELL MW-8



Project: BNSF Oil Pipeline Site
 Project Location: Tacoma, Washington
 Project Number: 0506-141-02

Figure: C-58
 Sheet 1 of 1

Date(s) Drilled	04/13/04	Logged By	NER	Checked By	DAR
Drilling Contractor	Holt Drilling	Drilling Method	HSA	Sampling Methods	Continuous (1.5-inch-split barrel)
Total Boring Depth (ft)	17.5	Hammer Data	140 (lb) hammer/ 30 (in) drop	Drilling Equipment	B-59 Truck Mount
Well Depth (ft)	16	Top of Well Elevation (ft)	16.83	Groundwater Elevation (ft)	8.33
System/ Datum					



LOG OF MONITORING WELL MW-9

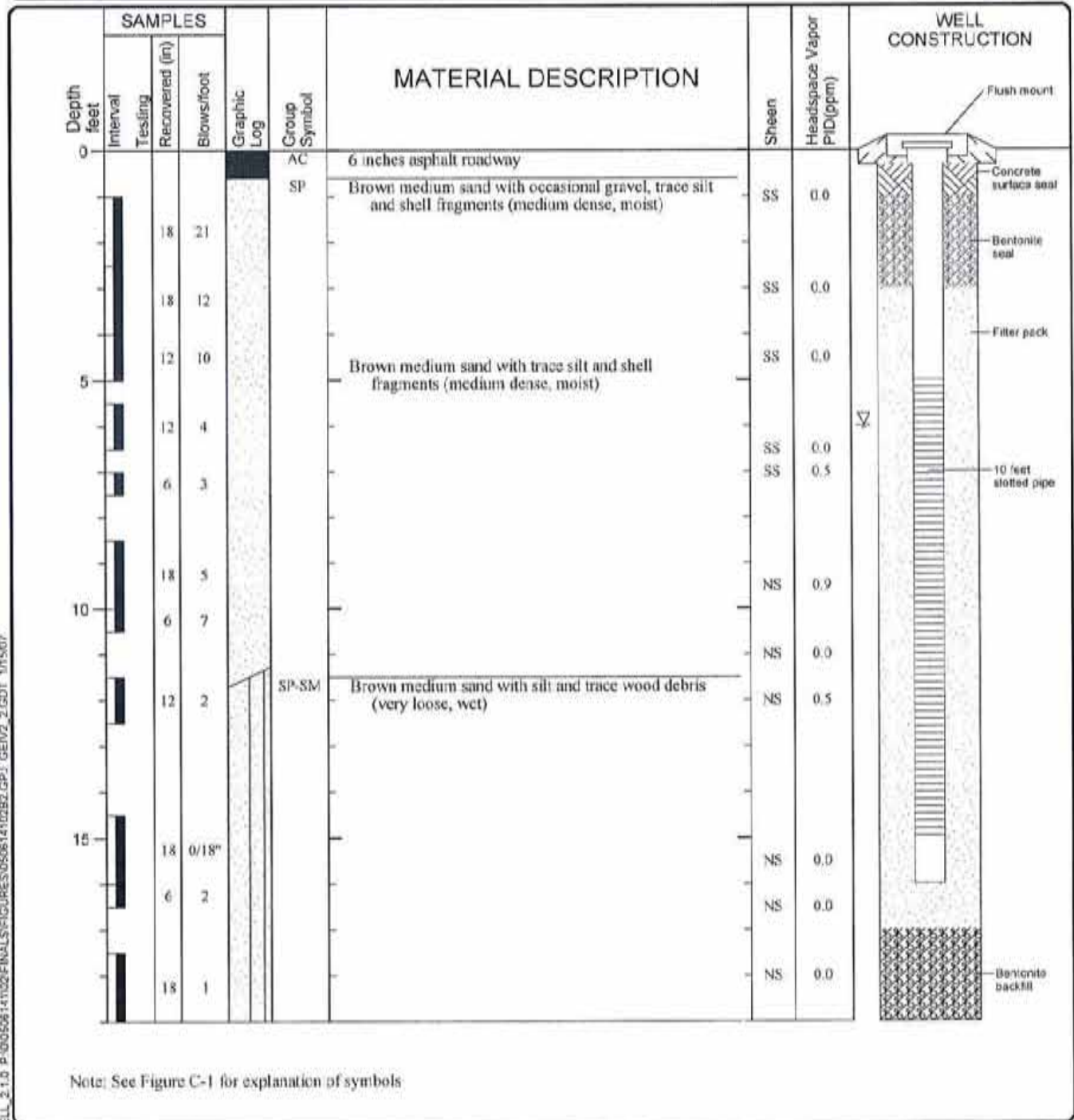


Project: BNSF Oil Pipeline Site
 Project Location: Tacoma, Washington
 Project Number: 0506-141-02

Figure: C-59
 Sheet 1 of 1

0506-141-02_GEOENGINEERS_2.1.0_P:\0506141\02\FINALS\FIGURES\0506141\02B2.GPJ_GEMVZ_2.CDT 1/15/07

Date(s) Drilled	04/13/04	Logged By	NER	Checked By	DAR
Drilling Contractor	Holt Drilling	Drilling Method	HSA	Sampling Methods	Continuous (1.5-inch-split barre)
Total Boring Depth (ft)	19	Hammer Data	140 (lb) hammer/ 30 (in) drop	Drilling Equipment	B-59 Truck Mount
Well Depth (ft)	16	Top of Well Elevation (ft)	16.15	Groundwater Elevation (ft)	10.15
System/ Datum					



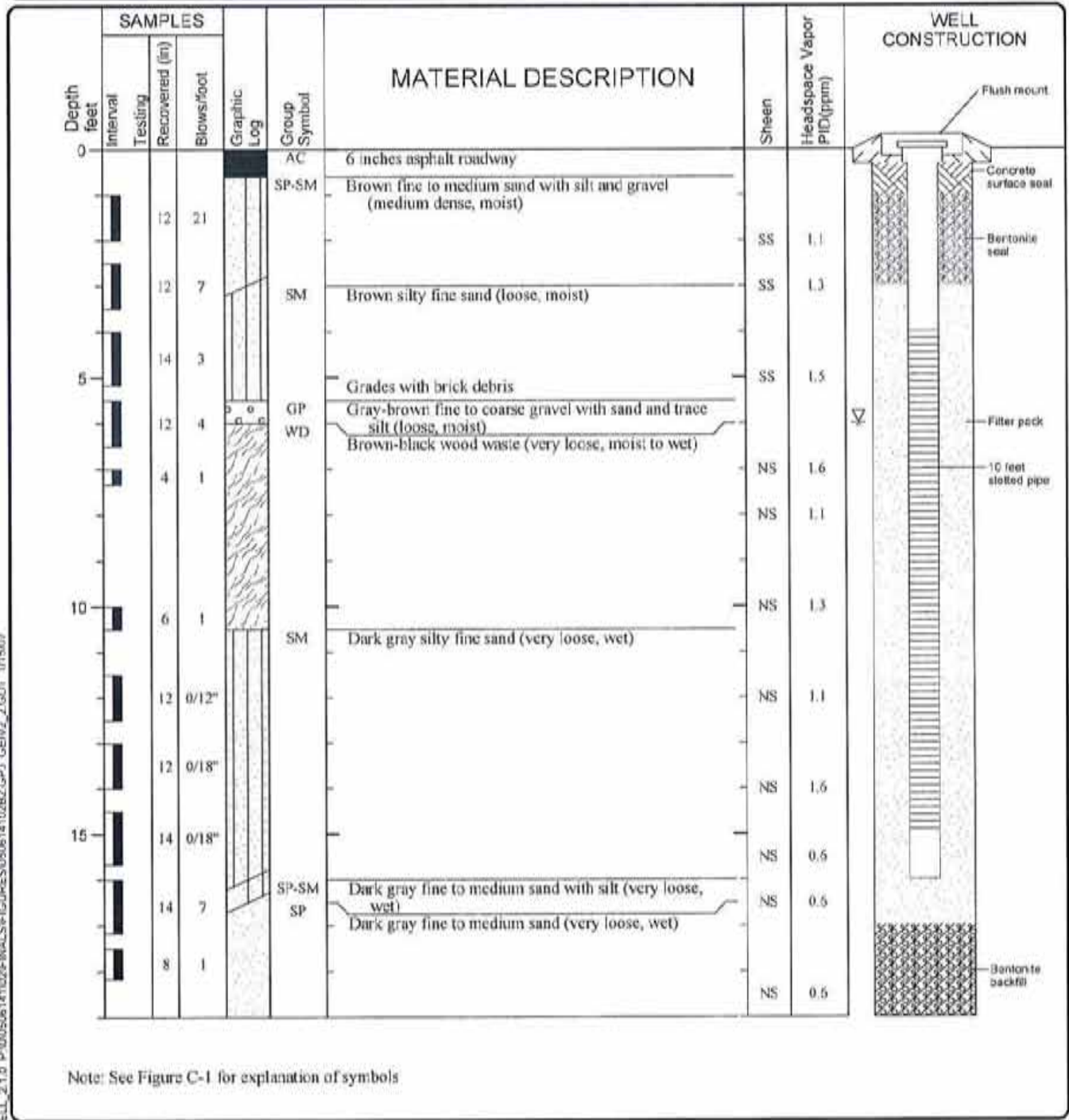
LOG OF MONITORING WELL MW-10



Project: BNSF Oil Pipeline Site
 Project Location: Tacoma, Washington
 Project Number: 0506-141-02

Figure: C-60
 Sheet 1 of 1

Date(s) Drilled	04/13/04	Logged By	NER	Checked By	DAR
Drilling Contractor	Holt Drilling	Drilling Method	HSA	Sampling Methods	Continuous (1.5-inch-split barre)
Total Boring Depth (ft)	19	Hammer Data	140 (lb) hammer/ 30 (in) drop	Drilling Equipment	B-59 Truck Mount
Well Depth (ft)	16	Top of Well Elevation (ft)	15.75	Groundwater Elevation (ft)	9.75
System/ Datum					



Note: See Figure C-1 for explanation of symbols

LOG OF MONITORING WELL MW-11

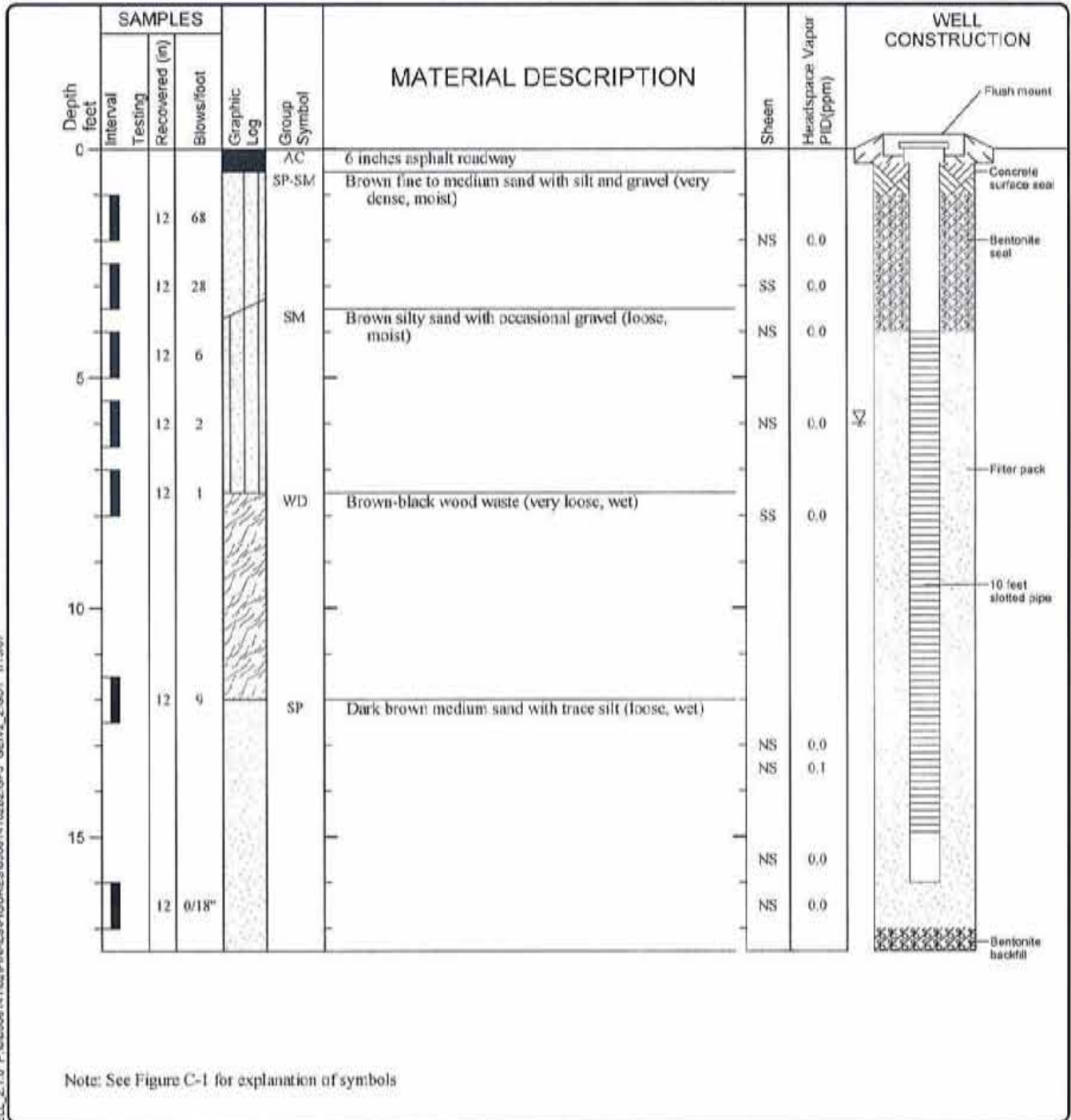


Project: BNSF Oil Pipeline Site
 Project Location: Tacoma, Washington
 Project Number: 0506-141-02

Figure: C-61
 Sheet 1 of 1

0506-141-02_GEI_ENVWELL_2.1.0_P:\00506141\02\FINALS\FIGURES\0506141\02B2.GPJ_GENV2_2.GDT 1/15/07

Date(s) Drilled	04/13/04	Logged By	NER	Checked By	DAR
Drilling Contractor	Holt Drilling	Drilling Method	HSA	Sampling Methods	Continuous (1.5-inch-split barrel)
Total Boring Depth (ft)	17.5	Hammer Data	140 (lb) hammer/ 30 (in) drop	Drilling Equipment	B-59 Truck Mount
Well Depth (ft)	16	Top of Well Elevation (ft)	15.50	Groundwater Elevation (ft)	9.5
System/ Datum					



LOG OF MONITORING WELL MW-12

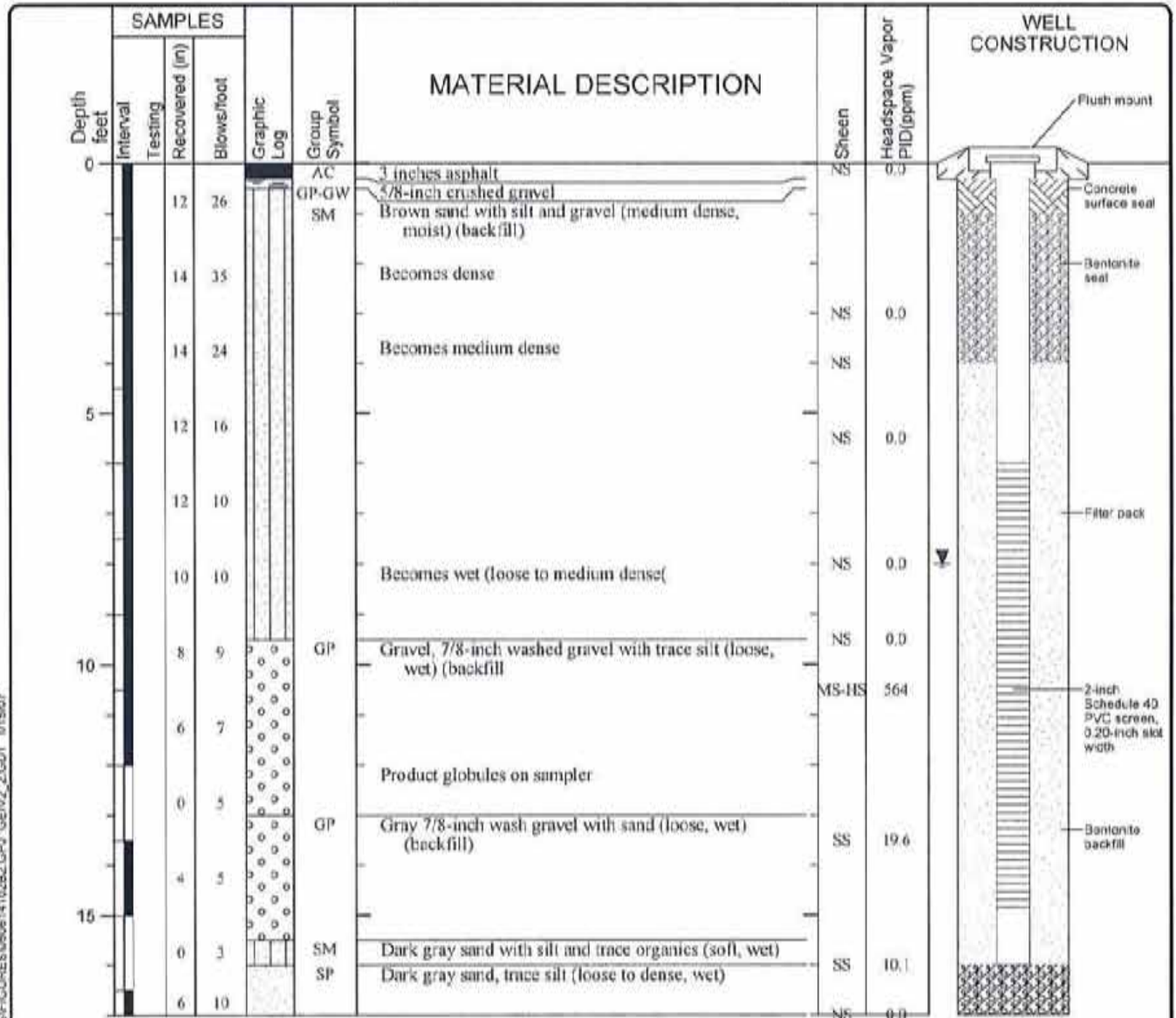


Project: BNSF Oil Pipeline Site
 Project Location: Tacoma, Washington
 Project Number: 0506-141-02

Figure: C-62
 Sheet 1 of 1

0506-141-02_GEL_ENVIRNELL_2.1.0_P:\0506141\02\FINALS\FIGURES\050614102B2.GPJ_GENV2_2.CDT 1/15/07

Date(s) Drilled	10/14/04	Logged By	NER	Checked By	GRL
Drilling Contractor	Holt Drilling	Drilling Method	SPT	Sampling Methods	SPT
Total Boring Depth (ft)	17	Hammer Data	140 (lb) hammer/ 30 (in) drop Autohammer	Drilling Equipment	B-59 Drill Rig Truck
Well Depth (ft)	17	Top of Well Elevation (ft)		Groundwater Level (ft. bgs)	8
System/ Datum					



Note: See Figure C-1 for explanation of symbols

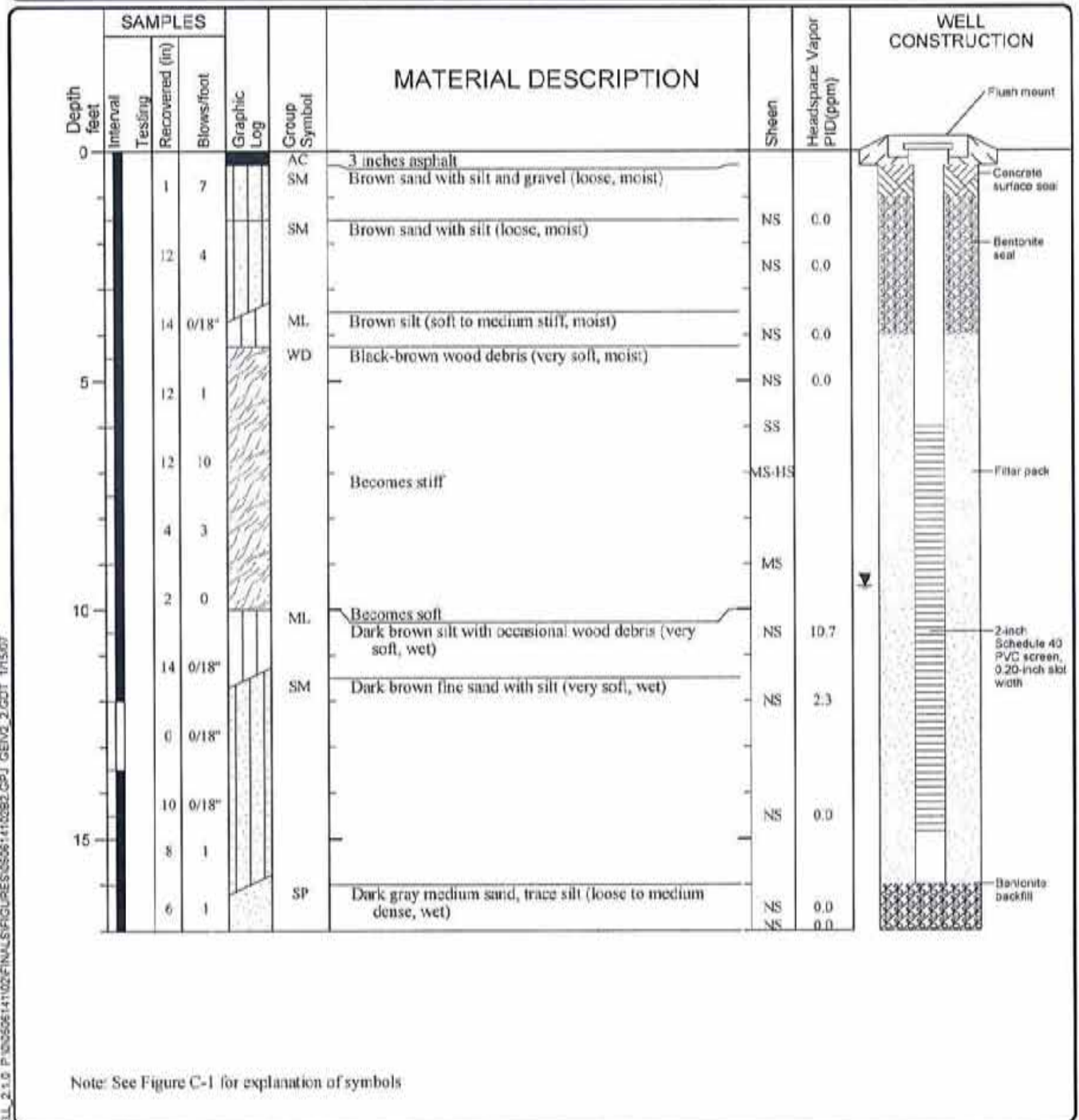
LOG OF MONITORING WELL MW-13



Project: BNSF Oil Pipeline Site
 Project Location: Tacoma, Washington
 Project Number: 0506-141-02

Figure: C-63
 Sheet 1 of 1

Date(s) Drilled	10/14/04	Logged By	NER	Checked By	GRL
Drilling Contractor	Holt Drilling	Drilling Method	SPT	Sampling Methods	SPT
Total Boring Depth (ft)	17	Hammer Data	140 (lb) hammer/ 30 (in) drop Autohammer	Drilling Equipment	B-59 Drill Rig Truck
Well Depth (ft)	17	Top of Well Elevation (ft)		Groundwater Level (ft. bgs)	9.5
System/ Datum					



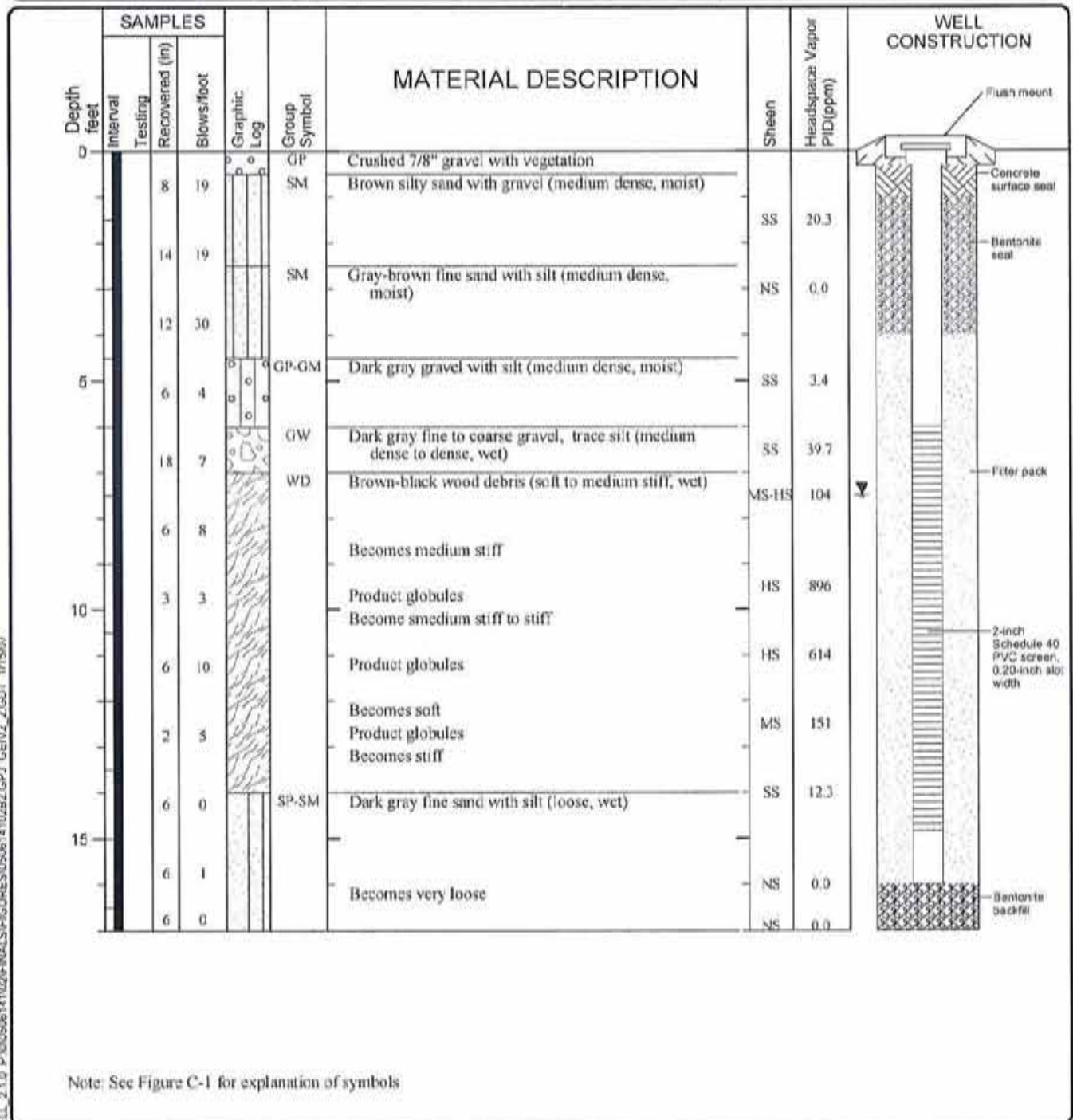
LOG OF MONITORING WELL MW-14



Project: BNSF Oil Pipeline Site
 Project Location: Tacoma, Washington
 Project Number: 0506-141-02

Figure: C-64
 Sheet 1 of 1

Date(s) Drilled	10/15/04	Logged By	NER	Checked By	GRL
Drilling Contractor	Holt Drilling	Drilling Method	SPT	Sampling Methods	SPT
Total Boring Depth (ft)	17	Hammer Data	140 (lb) hammer/ 30 (in) drop Autohammer	Drilling Equipment	B-59 Drill Rig Truck
Well Depth (ft)	17	Top of Well Elevation (ft)		Groundwater Level (ft. bgs)	7.5
System/ Datum					



0506-141-02_GEI_ENVWELL_2.1.0_P:\0506141\02\FINALS\FIGURES\0506141\02B2.GPJ_GEIV2_2.GJT_1/15/07

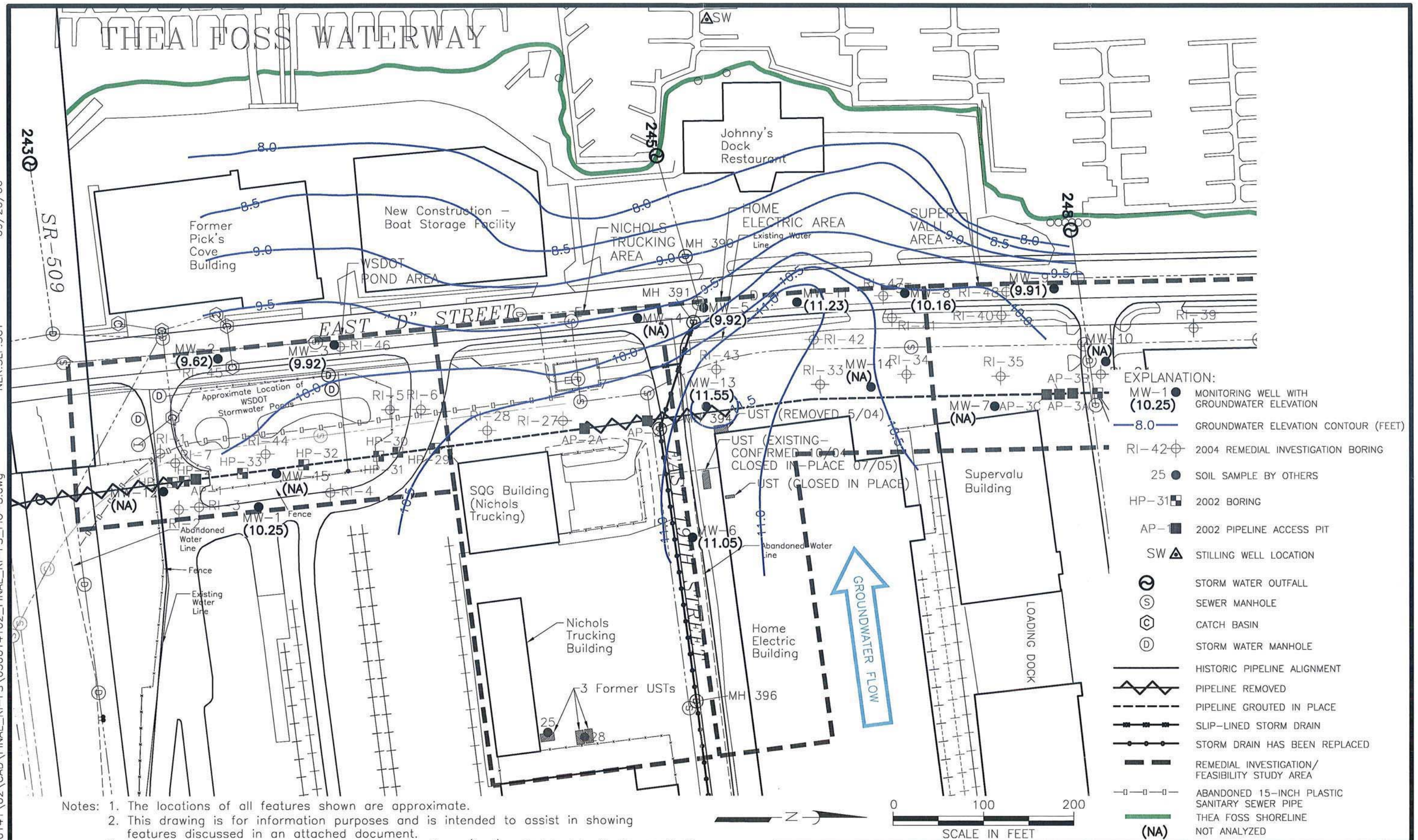
LOG OF MONITORING WELL MW-15		
	Project:	BNSF Oil Pipeline Site
	Project Location:	Tacoma, Washington
	Project Number:	0506-141-02
		Figure: C-65 Sheet 1 of 1

APPENDIX C
GROUNDWATER ELEVATION CONTOUR MAPS, 2004-
2006

9/20/06

NER:SLF:SCY

TACO\0\0506141\02\CAD\FINAL_RI-FS\050614102_FINAL_RI-FS_FIG-8.dwg



- EXPLANATION:**
- MW-1 ● (10.25) MONITORING WELL WITH GROUNDWATER ELEVATION
 - 8.0 — GROUNDWATER ELEVATION CONTOUR (FEET)
 - RI-42 ⊕ 2004 REMEDIAL INVESTIGATION BORING
 - 25 ● SOIL SAMPLE BY OTHERS
 - HP-31 ⊠ 2002 BORING
 - AP-1 ⊠ 2002 PIPELINE ACCESS PIT
 - SW ▲ STILLING WELL LOCATION
 - ⊙ STORM WATER OUTFALL
 - ⊙ SEWER MANHOLE
 - ⊙ CATCH BASIN
 - ⊙ STORM WATER MANHOLE
 - HISTORIC PIPELINE ALIGNMENT
 - PIPELINE REMOVED
 - - - PIPELINE GROUTED IN PLACE
 - - - SLIP-LINED STORM DRAIN
 - - - STORM DRAIN HAS BEEN REPLACED
 - - - REMEDIAL INVESTIGATION/FEASIBILITY STUDY AREA
 - - - ABANDONED 15-INCH PLASTIC SANITARY SEWER PIPE
 - THEA FOSS SHORELINE
 - (NA) NOT ANALYZED

Notes: 1. The locations of all features shown are approximate.
 2. This drawing is for information purposes and is intended to assist in showing features discussed in an attached document.
 3. Elevations shown are average water level elevations (feet) calculated by Serfes method (see text for details) from tidal study data collected from 2100 hrs., 3 Feb., 2006 to 2100 hrs., 6 Feb., 2006. Elevation Datum is MLLW. These data also represent conditions post-IA activities.

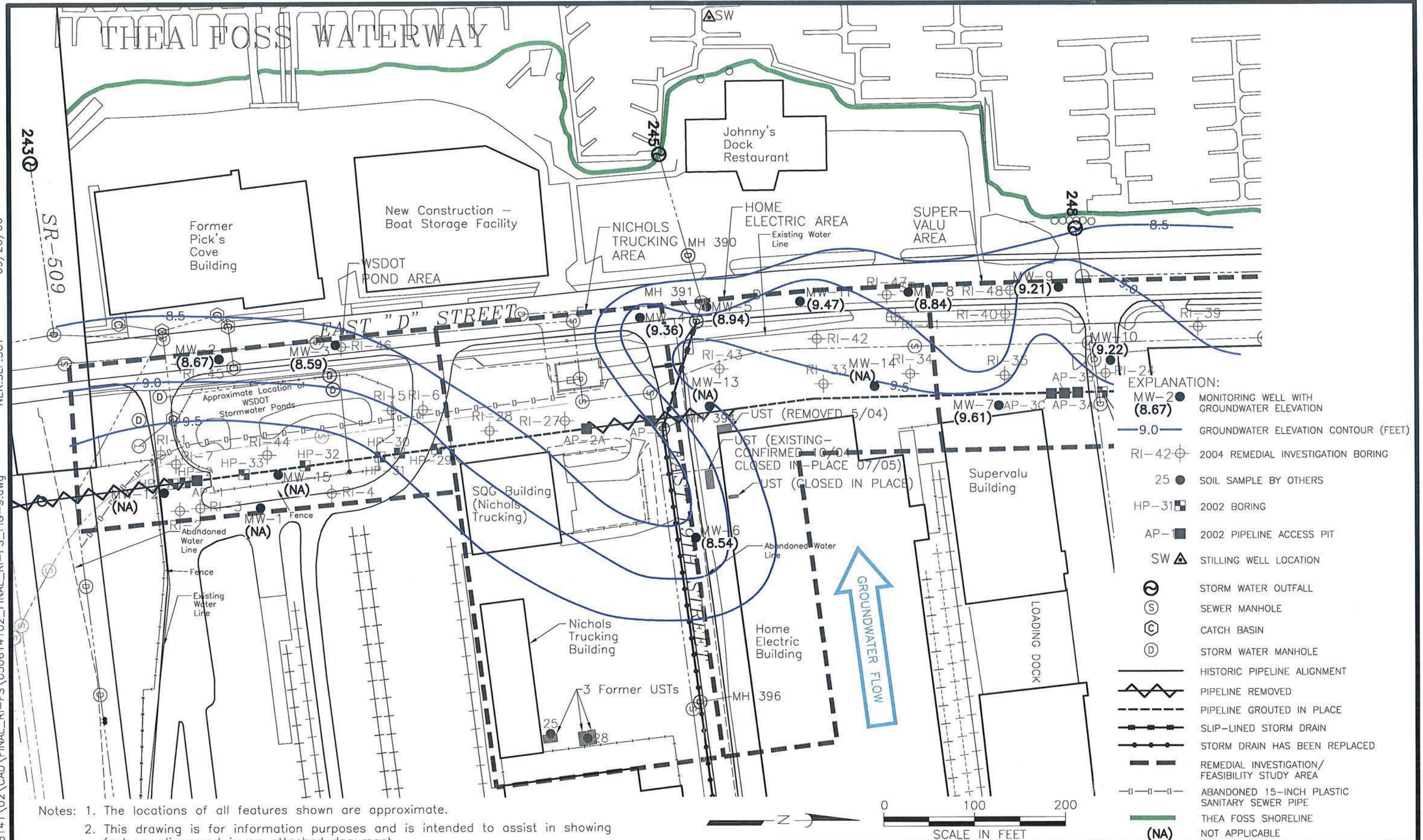
Reference: Drawing created from AutoCAD file, E.D st-oil line-b.DWG", provided by City of Tacoma.



POTENTIOMETRIC SURFACE CONTOURS
 FEBRUARY 2006

FIGURE 8

TACO\0\0506141\02\CAD\FINAL\RI-FS\050614102_FINAL_RI-FS_FIG-9.dwg
NER:SLF:SCY
09/20/06



- EXPLANATION:**
- MW-2 ● (8.67) MONITORING WELL WITH GROUNDWATER ELEVATION
 - 9.0— GROUNDWATER ELEVATION CONTOUR (FEET)
 - RI-42 ⊕ 2004 REMEDIAL INVESTIGATION BORING
 - 25 ● SOIL SAMPLE BY OTHERS
 - HP-31 ⊠ 2002 BORING
 - AP-1 ⊠ 2002 PIPELINE ACCESS PIT
 - SW ▲ STILLING WELL LOCATION
 - ⊙ STORM WATER OUTFALL
 - ⊙ SEWER MANHOLE
 - ⊙ CATCH BASIN
 - ⊙ STORM WATER MANHOLE
 - — — HISTORIC PIPELINE ALIGNMENT
 - — — PIPELINE REMOVED
 - — — PIPELINE GROUTED IN PLACE
 - — — SLIP-LINED STORM DRAIN
 - — — STORM DRAIN HAS BEEN REPLACED
 - — — REMEDIAL INVESTIGATION/FEASIBILITY STUDY AREA
 - — — ABANDONED 15-INCH PLASTIC SANITARY SEWER PIPE
 - — — THEA FOSS SHORELINE
 - (NA) NOT APPLICABLE

Notes: 1. The locations of all features shown are approximate.
 2. This drawing is for information purposes and is intended to assist in showing features discussed in an attached document.
 3. This figure represents groundwater elevations (feet) at the time of sampling and were not adjusted for tidal lag and efficiency. Therefore, groundwater elevations and contours are not considered accurate representations of site-wide conditions.

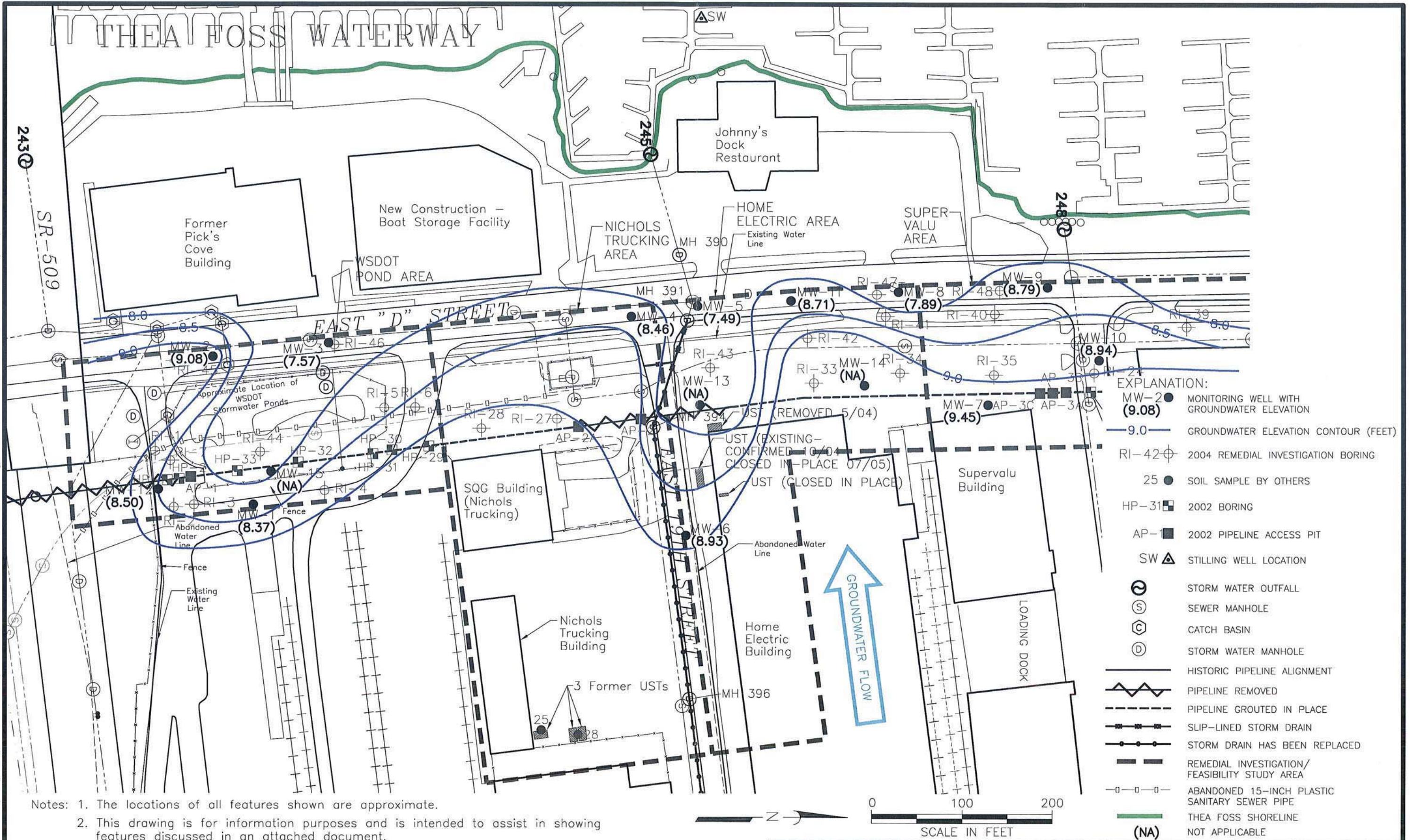
Reference: Drawing created from AutoCAD file, E.D st-oil line-b.DWG", provided by City of Tacoma.



GROUNDWATER ELEVATION CONTOURS
APRIL 2004

FIGURE 9

TACO\0506141\02\CAD\FINAL_RI-FS\050614102_FINAL_RI-FS_FIG-10.dwg
 NER:SLF:SCY
 09/20/06



Notes: 1. The locations of all features shown are approximate.
 2. This drawing is for information purposes and is intended to assist in showing features discussed in an attached document.
 3. This figure represents groundwater elevations (feet) at the time of sampling and were not adjusted for tidal lag and efficiency. Therefore, groundwater elevations and contours are not considered accurate representations of site-wide conditions.

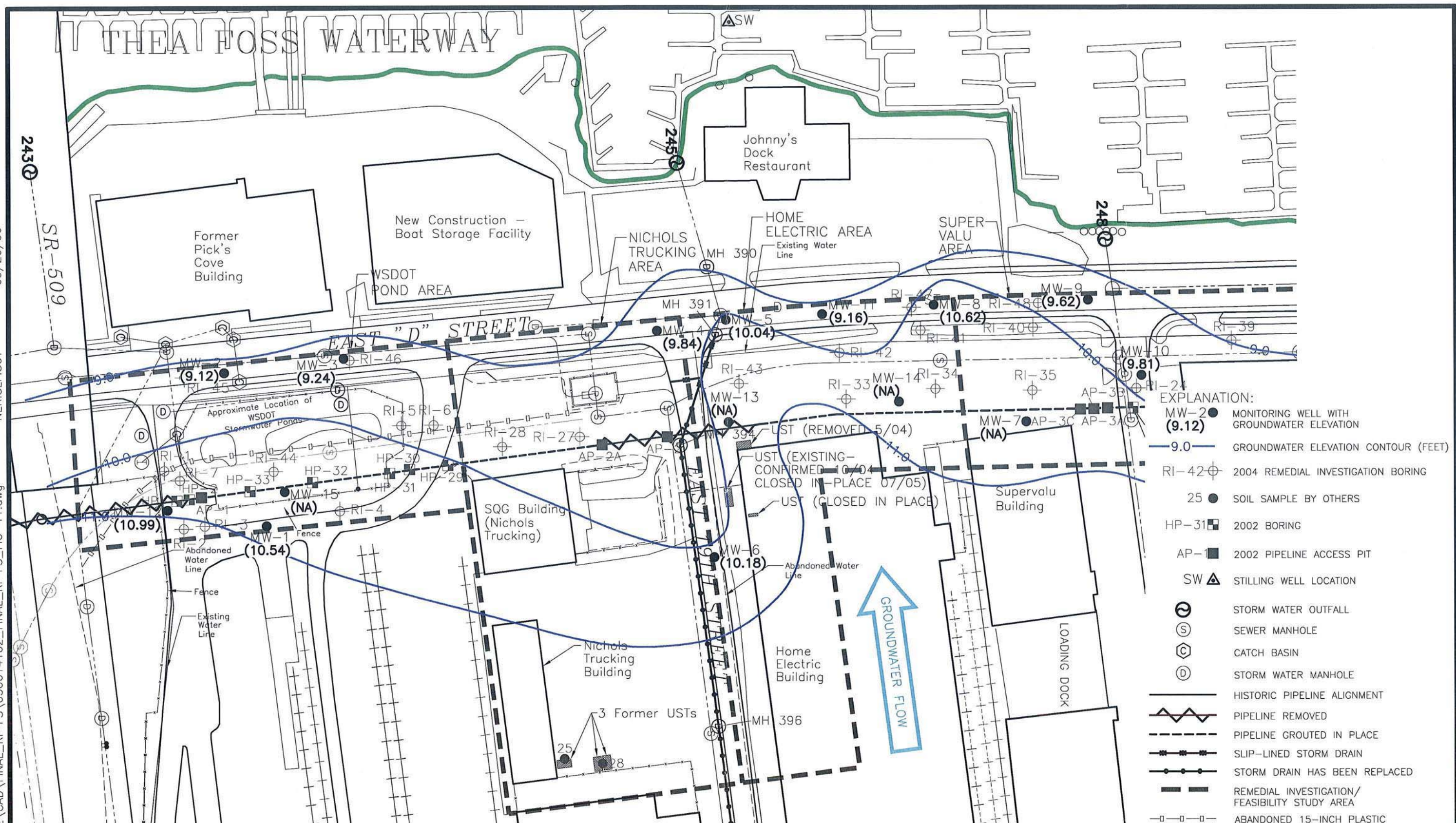
Reference: Drawing created from AutoCAD file, E.D st-oil line-b.DWG", provided by City of Tacoma.



GROUNDWATER ELEVATION CONTOURS
 JULY 2004

FIGURE 10

TACO\0\0506141\02\CAD\FINAL_RI-FS\050614102_FINAL_RI-FS_FIG-11.dwg
NER:SLF:SCY
09/20/06



- EXPLANATION:**
- MW-2 ● MONITORING WELL WITH GROUNDWATER ELEVATION
 - 9.0— GROUNDWATER ELEVATION CONTOUR (FEET)
 - RI-42 ⊕ 2004 REMEDIAL INVESTIGATION BORING
 - 25 ● SOIL SAMPLE BY OTHERS
 - HP-31 ⊕ 2002 BORING
 - AP-1 ■ 2002 PIPELINE ACCESS PIT
 - SW ▲ STILLING WELL LOCATION
 - ⊕ STORM WATER OUTFALL
 - ⊙ SEWER MANHOLE
 - ⊕ CATCH BASIN
 - ⊙ STORM WATER MANHOLE
 - — — HISTORIC PIPELINE ALIGNMENT
 - ⚡ PIPELINE REMOVED
 - - - PIPELINE GROUTED IN PLACE
 - - - SLIP-LINED STORM DRAIN
 - - - STORM DRAIN HAS BEEN REPLACED
 - - - REMEDIAL INVESTIGATION/FEASIBILITY STUDY AREA
 - - - ABANDONED 15-INCH PLASTIC SANITARY SEWER PIPE
 - THEA FOSS SHORELINE
 - (NA) NOT APPLICABLE

Notes: 1. The locations of all features shown are approximate.
 2. This drawing is for information purposes and is intended to assist in showing features discussed in an attached document.
 3. This figure represents groundwater elevations (feet) at the time of sampling and were not adjusted for tidal lag and efficiency. Therefore, groundwater elevations and contours are not considered accurate representations of site-wide conditions.

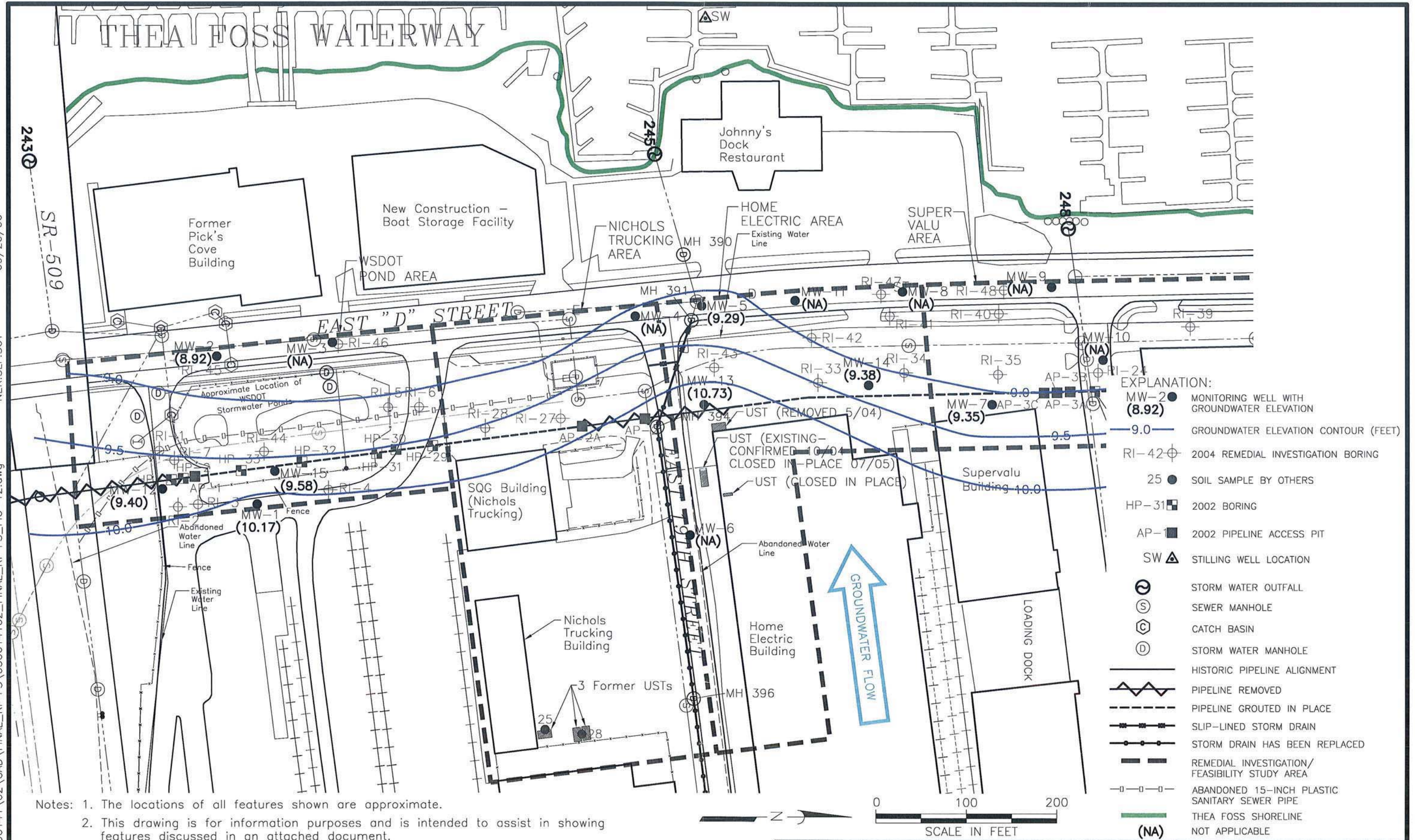
Reference: Drawing created from AutoCAD file, E.D st-oil line-b.DWG", provided by City of Tacoma.



GROUNDWATER ELEVATION CONTOURS
OCTOBER 2004

FIGURE 11

TACO\0\0506141\02\CAD\FINAL_RI-FS\050614102_FINAL_RI-FS_FIG-12.dwg 09/20/06 NER:SLF:SCY



- EXPLANATION:**
- MW-2 ● (8.92) MONITORING WELL WITH GROUNDWATER ELEVATION
 - 9.0— GROUNDWATER ELEVATION CONTOUR (FEET)
 - RI-42 ⊕ 2004 REMEDIAL INVESTIGATION BORING
 - 25 ● SOIL SAMPLE BY OTHERS
 - HP-31 ⊠ 2002 BORING
 - AP-1 ⊠ 2002 PIPELINE ACCESS PIT
 - SW ▲ STILLING WELL LOCATION
 - ⊙ STORM WATER OUTFALL
 - ⊙ S SEWER MANHOLE
 - ⊙ C CATCH BASIN
 - ⊙ D STORM WATER MANHOLE
 - — — HISTORIC PIPELINE ALIGNMENT
 - — — PIPELINE REMOVED
 - — — PIPELINE GROUTED IN PLACE
 - — — SLIP-LINED STORM DRAIN
 - — — STORM DRAIN HAS BEEN REPLACED
 - — — REMEDIAL INVESTIGATION/FEASIBILITY STUDY AREA
 - — — ABANDONED 15-INCH PLASTIC SANITARY SEWER PIPE
 - — — THEA FOSS SHORELINE
 - (NA) NOT APPLICABLE

Notes: 1. The locations of all features shown are approximate.
 2. This drawing is for information purposes and is intended to assist in showing features discussed in an attached document.
 3. This figure represents groundwater elevations (feet) at the time of sampling and were not adjusted for tidal lag and efficiency. Therefore, groundwater elevations and contours are not considered accurate representations of site-wide conditions.

Reference: Drawing created from AutoCAD file, E.D st-oil line-b.DWG", provided by City of Tacoma.

GROUNDWATER ELEVATION CONTOURS
JANUARY 2005

FIGURE 12

APPENDIX D
RECENT GROUNDWATER MONITORING WELL
READINGS

TABLE D-1
RECENT GROUNDWATER MONITORING
BNSF OIL PIPELINE (D STREET)
TACOMA, WASHINGTON

Location	April 2007 Depth to Water (Feet bgs)	July 2007 Depth to Water (Feet bgs)	October 2007 Depth to Water (Feet bgs)	January 2008 Depth to Water (Feet bgs)
MW-02	4.71	5.50	5.31	5.33
MW-03	4.78	5.38	5.21	4.43
MW-04	5.25	7.99	5.10	4.62
MW-05	5.84	6.24	5.95	NM
MW-07	7.69	8.00	7.88	7.49
MW-08	6.19	6.62	6.28	6.30
MW-09	7.11	7.58	7.74	7.75
MW-11	6.00	7.24	6.11	5.92
MW-14	5.50	5.68	5.80	5.80

Notes:

All wells are flush-mount.

Depth to water measured from top of casing.

bgs = below ground surface

NM = Not Measured

TACO:\0\0506141\02\Finals\Draft EDR Feb 2008\050614102_DraftR_Table D1.xls

APPENDIX E
FIELD EXPLORATIONS AND LABORATORY TESTING,
2008

APPENDIX E FIELD EXPLORATIONS AND LABORATORY TESTING

FIELD EXPLORATIONS

The subsurface conditions were explored by advancing two borings to 40.5 feet below ground surface (bgs) and two cone penetrometer tests (CPTs) to approximately 40 feet bgs. The borings (GT-1 and GT-2) were drilled on January 31, 2008, by Cascade Drilling under subcontract to GeoEngineers, Inc. The borings were completed using a hollow-stem auger and split spoon sampling techniques.

During drilling, our field representative obtained samples, classified the soils, maintained a detailed log of each exploration and observed groundwater conditions where applicable. The samples were taken with a 2.4-inch-inside-diameter split spoon ring sampler. The samples were retained in sealed plastic bags. The soils were classified in general accordance with the system described in Figure E-1, which includes a key to the exploration logs. Summary logs of the explorations are included as Figures E-2 and E-3.

The CPTs (CPT-1 and CPT-2) were performed on February 13, 2008, by In-Situ Engineering under subcontract to GeoEngineers. The upper 6 feet of sounding CPT-2 was pre-drilled to avoid underground utilities. The CPT logs for the soundings are included as Figures E-4 and E-5.

The locations of the explorations were determined by pacing from existing structures. The elevations presented on the boring logs are based on the topographic survey data provided by the Port of Tacoma. The elevation datum is mean lower low water (MLLW). The locations and elevations of the explorations should be considered approximate. The exploration locations, existing structures and other site features are shown in Figures 2 through 5.

LABORATORY TESTING

Soil samples obtained from the borings were transported to GeoEngineers' laboratory. Representative soil samples were selected for laboratory tests to evaluate their pertinent geotechnical engineering properties.

MOISTURE CONTENT AND DENSITY

The moisture content and dry density of selected samples were determined in general accordance with ASTM Test Methods D 2216 and D 2937, respectively. The test results are used to aid in soil classification and provide correlation with other pertinent engineering soil properties, and are presented on the boring logs in Figures E-2 and E-3.

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS
			GRAPH	LETTER	
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS <small>(LITTLE OR NO FINES)</small>		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES
		GRAVELS WITH FINES <small>(APPRECIABLE AMOUNT OF FINES)</small>		GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES
		SAND AND SANDY SOILS		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN SANDS <small>(LITTLE OR NO FINES)</small>		SW	WELL-GRADED SANDS, SAND-GRAVEL MIXTURES
		SANDS WITH FINES <small>(APPRECIABLE AMOUNT OF FINES)</small>		SP	POORLY-GRADED SANDS, SAND-GRAVEL MIXTURES
		SANDS WITH FINES <small>(APPRECIABLE AMOUNT OF FINES)</small>		SM	SILTY SANDS, SAND - SILT MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS, ROCK FLOUR, CLAYEY SILTS WITH SLIGHT PLASTICITY
		LIQUID LIMIT LESS THAN 50		CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
		LIQUID LIMIT LESS THAN 50		OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS SILTY SOILS
		LIQUID LIMIT GREATER THAN 50		CH	INORGANIC CLAYS OF HIGH PLASTICITY
		LIQUID LIMIT GREATER THAN 50		OH	ORGANIC CLAYS AND SILTS OF MEDIUM TO HIGH PLASTICITY
HIGHLY ORGANIC SOILS			PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS	

NOTE: Multiple symbols are used to indicate borderline or dual soil classifications

Sampler Symbol Descriptions

- 2.4-inch I.D. split barrel
- Standard Penetration Test (SPT)
- Shelby tube
- Piston
- Direct-Push
- Bulk or grab

Blowcount is recorded for driven samplers as the number of blows required to advance sampler 12 inches (or distance noted). See exploration log for hammer weight and drop.

A "P" indicates sampler pushed using the weight of the drill rig.

ADDITIONAL MATERIAL SYMBOLS

SYMBOLS		TYPICAL DESCRIPTIONS
GRAPH	LETTER	
	CC	Cement Concrete
	AC	Asphalt Concrete
	CR	Crushed Rock/ Quarry Spalls
	TS	Topsoil/ Forest Duff/Sod



Measured groundwater level in exploration, well, or piezometer



Groundwater observed at time of exploration



Perched water observed at time of exploration



Measured free product in well or piezometer

Graphic Log Contact



Distinct contact between soil strata or geologic units



Approximate location of soil strata change within a geologic soil unit

Material Description Contact



Distinct contact between soil strata or geologic units



Approximate location of soil strata change within a geologic soil unit

Laboratory / Field Tests

- %F Percent fines
- AL Atterberg limits
- CA Chemical analysis
- CP Laboratory compaction test
- CS Consolidation test
- DS Direct shear
- HA Hydrometer analysis
- MC Moisture content
- MD Moisture content and dry density
- OC Organic content
- PM Permeability or hydraulic conductivity
- PP Pocket penetrometer
- SA Sieve analysis
- TX Triaxial compression
- UC Unconfined compression
- VS Vane shear

Sheen Classification

- NS No Visible Sheen
- SS Slight Sheen
- MS Moderate Sheen
- HS Heavy Sheen
- NT Not Tested

NOTE: The reader must refer to the discussion in the report text and the logs of explorations for a proper understanding of subsurface conditions. Descriptions on the logs apply only at the specific exploration locations and at the time the explorations were made; they are not warranted to be representative of subsurface conditions at other locations or times.

KEY TO EXPLORATION LOGS

Date(s) Drilled	01/31/08	Logged By	CAM	Checked By	CAM
Drilling Contractor	Cascade Drilling	Drilling Method	Hollow-stem Auger	Sampling Methods	D&M
Auger Data	6.5 inches ID	Hammer Data	140 lb hammer/30 in drop automatic	Drilling Equipment	CME-75
Total Depth (ft)	40.5	Surface Elevation (ft)	16	Groundwater Elevation (ft)	4
Vertical Datum	MLLW	Datum/System	N/A	Easting(x): Northing(y):	

Elevation feet	SAMPLES				Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Moisture Content %	Dry Unit Weight, lbs/ft ³	OTHER TESTS AND NOTES
	Depth feet	Interval	Recovered (in)	Blows/foot							
0							SM	Gray silty fine sand with trace organics (loose, moist) (soil fill)			
1.5		18	15	1							
5		0	8	-			WD	Brown and black wood debris (very loose, moist to wet) (wood debris fill)			
10		0	10	-							
15		12	15	2			SP-SM	Black fine sand with silt and occasional organics (loose, wet) (alluvium)	21	100	
16.5		18	10	3				Grades to very loose	17	105	
18		18	6	4							
20		18	6	5							
21.5		18	10	6			SP-SM	Gray fine sand with silt and sea shells lensed with gray sandy silt with sea shells (very loose, wet)	17	100	
23		18	22	7				Grades to loose			
24.5		18	16	8							
26		18	18	9					16	101	
27.5		18	7	10				Grades to very loose			
29		18	9	11							
30.5		1	3	12							
32		18	19	13			SM	Gray silty fine sand with abundant sea shells (loose, wet)			
33.5		18	7	14				Grades to very loose			
35		18	16	15				Grades to loose	18	108	
36.5		18	21	16			SP	Black fine to medium sand with sea shells and trace silt (loose, wet)			
38		18	26	17				Grades to medium dense			
39.5		18	17	18				Grades to loose	17	94	

Note: See Figure E-1 for explanation of symbols.

VB_GTBORING P:\020006\14102\FINAL\SIG506\14102.GPJ GEV6_1.GDT 3/4/08

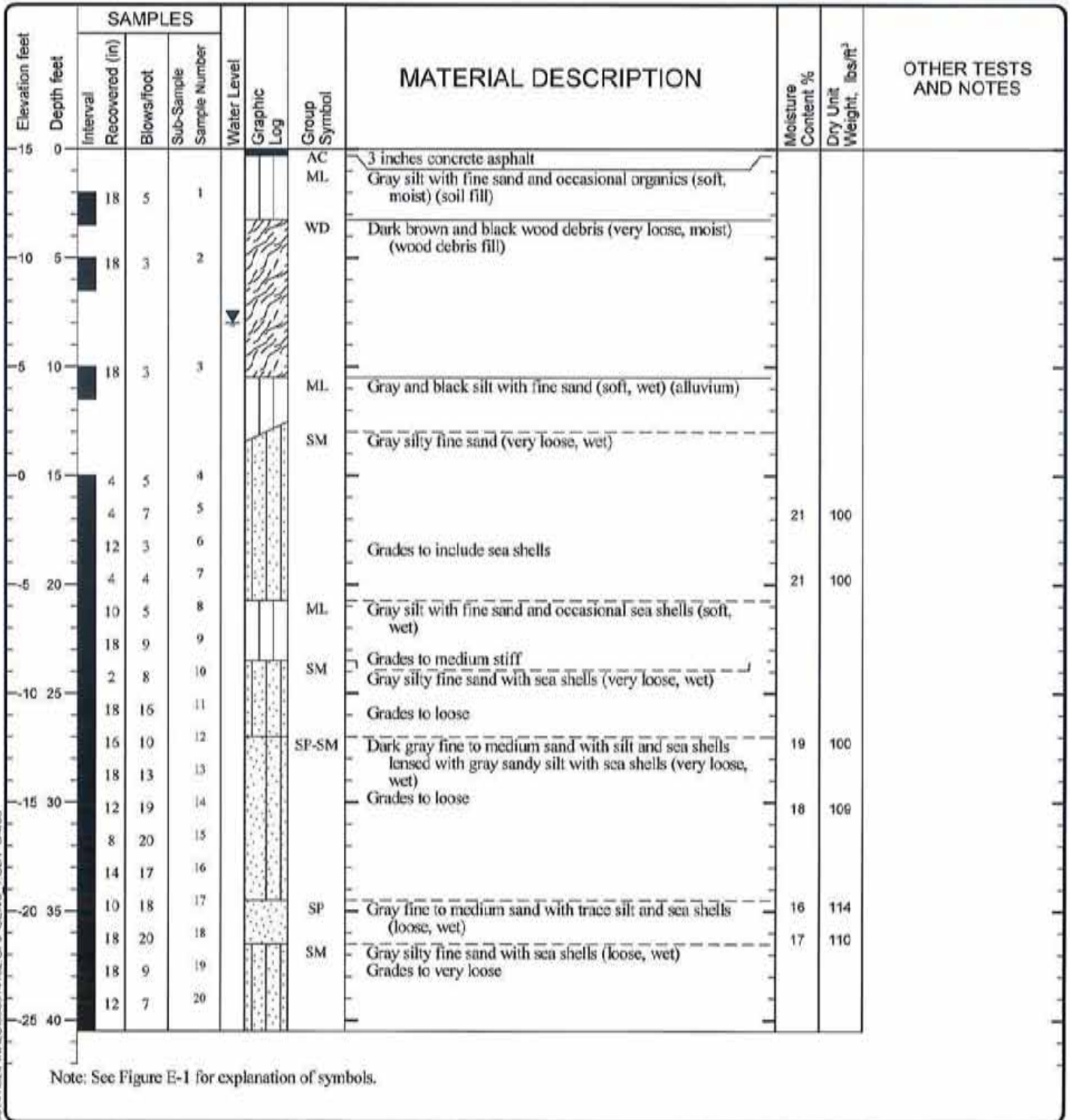
LOG OF BORING GT-1



Project: BNSF Oil Pipeline Site (D Street)
 Project Location: Tacoma, Washington
 Project Number: 0506-141-02

Figure E-2
 Sheet 1 of 1

Date(s) Drilled	01/31/08	Logged By	CAM	Checked By	CAM
Drilling Contractor	Cascade Drilling	Drilling Method	Hollow-stem Auger	Sampling Methods	D&M
Auger Data	6.5 inches ID	Hammer Data	140 lb hammer/30 in drop automatic	Drilling Equipment	CME-75
Total Depth (ft)	40.5	Surface Elevation (ft)	15	Groundwater Elevation (ft)	7
Vertical Datum	MLLW	Datum/System	N/A	Easting(x):	Nothing(y):



U6_GTBORING_P:\050614102\FINAL\5050614102.GPJ GEIWB_1.GDT 3/4/08

LOG OF BORING GT-2

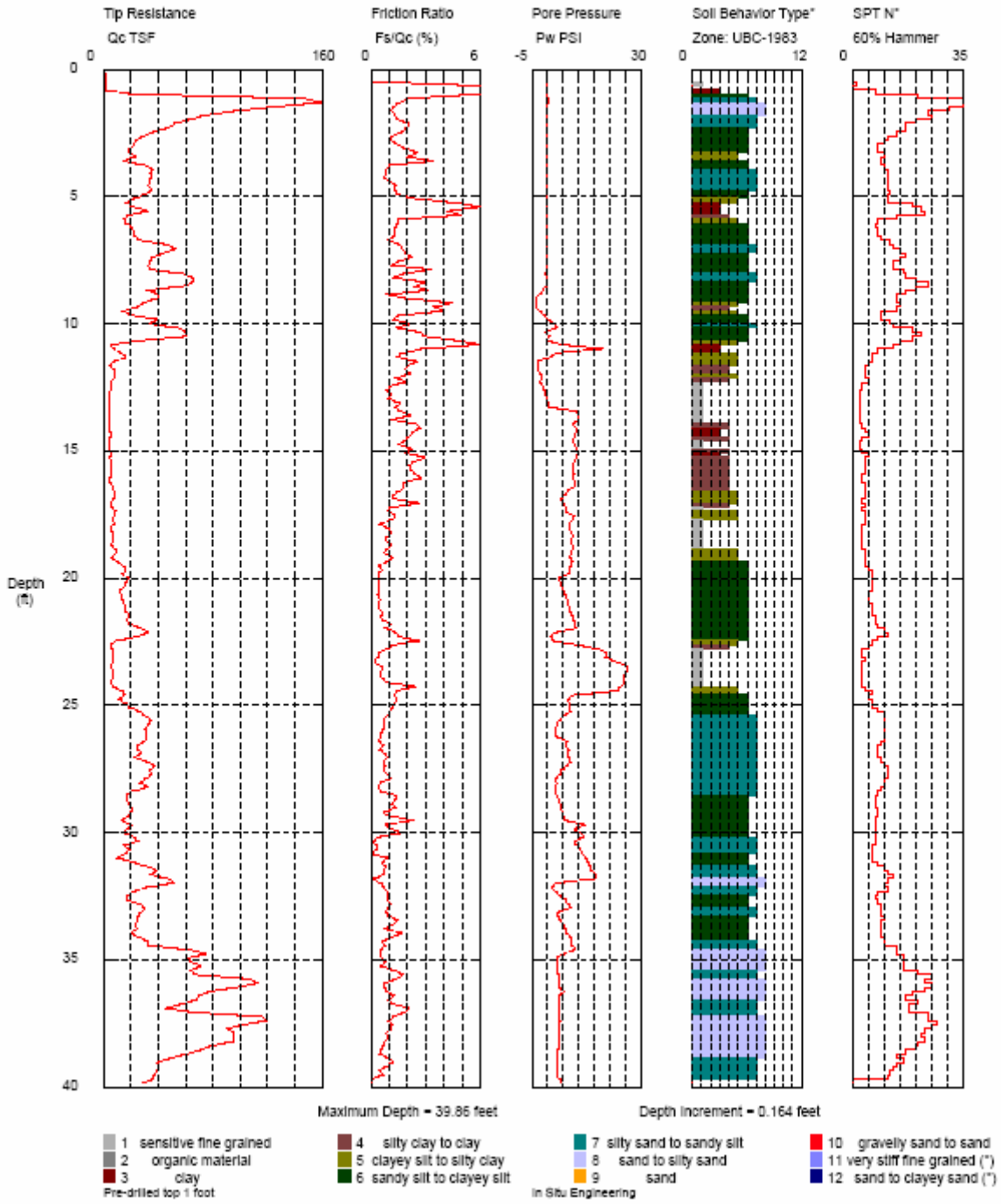


Project: BNSF Oil Pipeline Site (D Street)
 Project Location: Tacoma, Washington
 Project Number: 0506-141-02

GeoEngineers, Inc.

Operator: Brown
Sounding: CPT-01
Cone Used: DSG1029

CPT Date/Time: 2/13/2008 8:07:13 AM
Location: D Street
Job Number: 0506-141-02



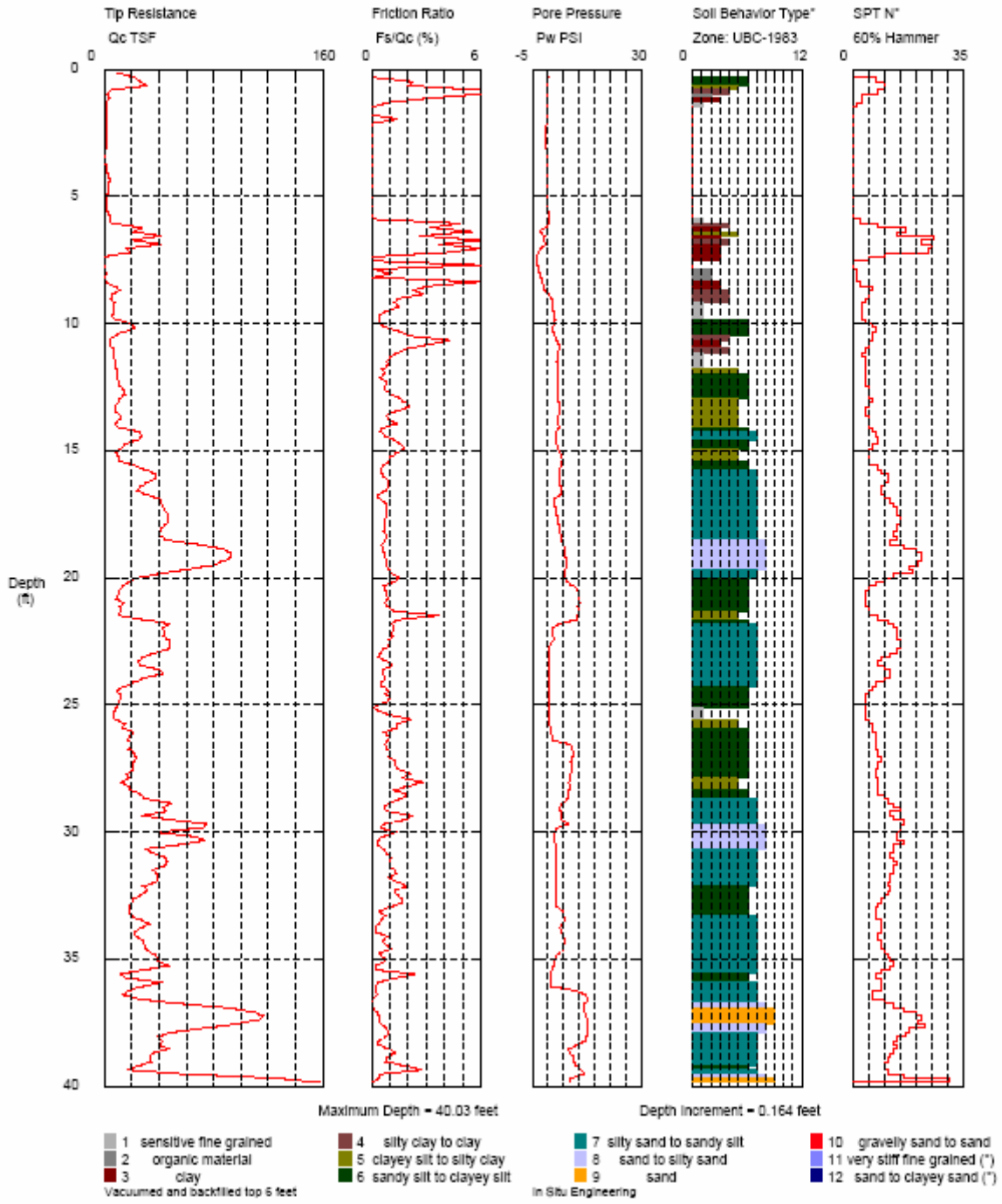
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CPT-1	
BNSF Oil Pipeline (D Street) Tacoma, Washington	
GEOENGINEERS	Figure E-4

GeoEngineers, Inc.

Operator: Brown
Sounding: CPT-02
Cone Used: DSG1029

CPT Date/Time: 2/13/2008 8:49:20 AM
Location: D Street
Job Number: 0506-141-02



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CPT-2	
BNSF Oil Pipeline (D Street) Tacoma, Washington	
GEOENGINEERS	Figure E-5



APPENDIX C
GEOTECHNICAL REPORT



DRAFT

**DRAFT REPORT
GEOTECHNICAL ENGINEERING SERVICES
BNSF OIL PIPELINE SITE
TACOMA, WASHINGTON**

MARCH 3, 2008

**FOR
BNSF RAILWAY COMPANY**

**Geotechnical Engineering Services
File No. 0506-141-02**

March 3, 2008

Prepared for:

**BNSF Railway Company
2454 Occidental Avenue South, Suite 1A
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TABLE OF CONTENTS

	<u>Page No.</u>
INTRODUCTION.....	1
PROJECT UNDERSTANDING AND SCOPE.....	1
REVIEW SUMMARY.....	2
INTERIM ACTION, 2004.....	2
FINAL REMEDIAL INVESTIGATION/FEASIBILITY STUDY, 2007.....	2
SITE CONDITIONS.....	2
SITE HISTORY	2
SURFACE CONDITIONS	3
SITE GEOLOGY	3
SUBSURFACE CONDITIONS.....	3
General.....	3
Soil Conditions.....	4
Groundwater Conditions.....	4
CONCLUSIONS AND RECOMMENDATIONS.....	5
GENERAL	5
SITE PREPARATION AND EARTHWORK	5
General.....	5
Subgrade Preparation, Evaluation and Protection	5
Existing Utilities	6
Excavation Support	6
Temporary Slopes	6
FILL MATERIALS.....	7
General.....	7
Structural Fill.....	7
Select Structural Fill.....	7
Crushed Rock.....	7
Ballast (Rock Spalls)	7
STRUCTURAL FILL PLACEMENT AND COMPACTION.....	8
Settlement Considerations	8
SHEET PILE WALL.....	8
General.....	8
Earth Pressures on the Sheet Pile Wall	8
Seismic Considerations	9
Shoring Wall Alignment Considerations	9
Pile Embedment and Deflection	9
Construction Considerations	10
Excavation Dewatering.....	10
LIMITATIONS.....	11

List of Tables

Table 1. Soil Parameters Used for Pressure Diagrams and Provided for LPILE Analysis.....	9
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TABLE OF CONTENTS (CONTINUED)

List of Figures

- Figure 1. Vicinity Map
- Figure 2. Overall Site Plan, Geotechnical Report
- Figure 3. Site Plan – Area A, Geotechnical Report
- Figure 4. Site Plan – Areas B and C, Geotechnical Report
- Figure 5. Site Plan – Area D, Geotechnical Report
- Figure 6. Earth Pressure Diagram (Case 1)
- Figure 7. Earth Pressure Diagram (Case 2)

APPENDICES

- APPENDIX A – INTERIM ACTION PHOTOGRAPHS, 2004
- APPENDIX B – LOG OF SELECT ENVIRONMENTAL BORINGS, 2004
- APPENDIX C – GROUNDWATER ELEVATION CONTOUR MAPS, 2004-2006
- APPENDIX D – RECENT GROUNDWATER MONITORING WELL READINGS

Appendix D Table

- Table D-1. Recent Groundwater Monitoring

- APPENDIX E – FIELD EXPLORATIONS AND LABORATORY TESTING, 2008

Appendix E Figures

- Figure E-1. Key to Exploration Logs
- Figures E-2 and E-3. Log of Borings
- Figures E-4 and E-5. CPT Logs

- APPENDIX F – REPORT LIMITATIONS AND GUIDELINES FOR USE

**DRAFT REPORT
GEOTECHNICAL ENGINEERING SERVICES
BNSF OIL PIPELINE SITE
TACOMA, WASHINGTON
FOR
BNSF RAILWAY COMPANY**

INTRODUCTION

This draft report presents the results of our geotechnical engineering studies associated with the BNSF Oil Pipeline site remediation project located in the East D Street corridor in Tacoma, Washington. The site location is shown in Figure 1. This geotechnical report is intended for inclusion in the Draft Engineering Design Report (EDR) currently being prepared by for the project. The Draft EDR is a compilation of environmental documents, along with construction plans and specifications intended for use by potential contractors to prepare a bid for the remedial excavation project described below.

The draft EDR will include structural plans and specifications for temporary sheet pile shoring walls, prepared by KPFF Consulting Engineers. All other plan sheets and specifications are to be prepared by GeoEngineers. The structural engineer will use the geotechnical information provided in this report as a basis for the structural design of the sheet pile shoring walls.

The recommended sheet pile wall layout will be prepared by GeoEngineers and is intended as a basis for contractor bidding. The selected contractor to perform the work will be requested to provide a detailed shoring design for the remedial excavation described below.

PROJECT UNDERSTANDING AND SCOPE

The project includes remedial excavation of soil contamination in four areas (Areas A through D) in the vicinity of East D Street. Excavation areas and other details are shown on the Overall Site Plan, Figure 2. The current remediation plan targets removal of soil contaminated with bunker range petroleum hydrocarbon (BRPH) with concentrations of 2,000 milligrams/kilogram (mg/kg) or greater. The aerial extent of the four proposed remediation areas is shown on Figures 3 through 5.

The proposed excavation depth is 12 feet below ground surface (bgs), with the exception of Area D, where the proposed excavation depth is 5 feet bgs. The proposed excavations are to be completed using a combination of temporary cantilevered sheet pile wall shoring and temporary open cut slopes. The proposed sheet pile wall locations and cut slope areas are shown on Figures 3 through 5.

Our understanding of site soil and groundwater conditions is based on our review of existing information and on four subsurface explorations performed specifically for this geotechnical study. The existing information includes accounts and photographs from a remedial excavation project in the vicinity of Areas B and C that was completed in 2004 (2004 interim action), and an environmental report prepared by GeoEngineers in 2007. The 2007 environmental report includes a number of boring logs in the project vicinity and provides detailed groundwater information. Our review summary is discussed in the following section of this report.

To supplement our review of existing subsurface information, we advanced two geotechnical borings (GT-1 and GT-2) on January 31, 2008, and two CPT soundings (CPT-1 and CPT-2) on February 13,

2008. Samples were obtained from the borings for geotechnical laboratory testing. The approximate location of the explorations is shown on Figures 4 and 5.

Potential difficulties associated with the completing the remedial excavation include high groundwater levels and variable subsurface conditions that include a layer of wood debris. Groundwater levels will need to be lowered within the excavation in order to facilitate excavations to 12 feet bgs, fill placement and compaction. Obstructions, including wood debris, could potentially impact sheet pile installation.

This report provides geotechnical recommendations for design and construction of temporary cantilever sheet pile walls, temporary cut slopes, and recommendations for structural fill placement and compaction. We understand that dewatering behind the sheet pile walls will not be utilized, resulting in the potential for differential hydrostatic pressure.

This report addresses two specific sheet pile wall configurations: 1) a 12-foot-high wall with a level backslope and 2) an 8-foot-high wall with a 2H:1V (horizontal:vertical) backslope. These configurations are detailed on the Earth Pressure Diagrams, Figures 6 and 7, and include a specific assumed differential hydrostatic pressure for each case. Our earth pressure diagrams have been provided to the project structural engineer, KPFF Consulting Engineers, as a basis for their sheet pile wall design. Information developed by KPFF regarding minimum sheet section size, minimum embedment depth and anticipated deflection are provided in the “Pile Embedment and Deflection” section of this report.

REVIEW SUMMARY

INTERIM ACTION, 2004

Between June 2004 and August 2004 GeoEngineers implemented an interim action remediation project in the vicinity of Areas B and C. This project included the removal of contaminated soil, wood debris and groundwater to the aerial extent identified in Figures 2 and 4 as “Interim Action Area.” The remedial excavation was completed utilizing a combination of temporary excavation cut slopes and temporary shoring. The subsurface conditions encountered in the excavation are summarized below. Representative photographs of the soil and groundwater conditions encountered during the 2004 interim action are included in Appendix A. A summary of the subsurface soil and groundwater conditions is presented in the “Subsurface Conditions” section of this report.

FINAL REMEDIAL INVESTIGATION/FEASIBILITY STUDY, 2007

We reviewed GeoEngineers report titled “Final Remedial Investigation/Feasibility Study,” dated April 4, 2007, for an understanding of site soil and groundwater conditions. This report is a compilation of environmental documents and includes subsurface soil and groundwater information. The locations of borings associated with the 2007 report (environmental borings performed in 2004), and considered relevant to this study, are shown on Figures 2 through 5. Logs of select borings are included in Appendix B. A summary of the subsurface soil and groundwater conditions is presented in the “Subsurface Conditions” section of this report.

SITE CONDITIONS

SITE HISTORY

Prior to development, the ground surface in the site and site vicinity consisted of mud flats and tidal marshes, exposed only at extreme low tides. Filling and dredging of the nearby waterways began around the beginning of the 20th Century. Located just east of the site, the Thea Foss Waterway, also known as

the City Waterway, was one of the first areas to be developed into its current configuration. By 1923, the Thea Foss Waterway had been dredged to a navigable depth, and the tidal marshes to the east of the Waterway, including the subject site, had been filled.

SURFACE CONDITIONS

The site is located east of the Thea Foss Waterway in Tacoma, Washington. This area is currently developed predominately as light industrial. The site surface is generally level and covered by asphalt, gravel and existing structures. Based on survey data provided by the City of Tacoma, Areas A, B and C are around Elevation 15 feet mean lower low water (MLLW). Area D is near Elevation 20 feet (MLLW). The existing site conditions and topography are shown in Figures 2 through 5.

SITE GEOLOGY

The geology in the project area is predominantly comprised of river delta deposits of the Puyallup River, Hylebos Creek, Wapato Creek and their ancestral predecessors. The deposition began after glacial ice had retreated north into present-day Canada and the sea had filled in what is now Puget Sound.

Geologic conditions at the site were evaluated in part by reviewing the “Geologic Map of the Tacoma North 7.5-Minute Quadrangle” (Troost, K.G., and Booth, D.B., in review). The map classifies the site and surrounding areas as Artificial Fill (map unit ‘af’). The artificial fill in the area is described to “variously consist of gravel, sand, silt, concrete, garbage, and other materials.”

We also reviewed “Geology of the Port of Tacoma,” produced by Hart Crowser and Associates Inc. This publication indicates that borings “Loop 5,” “Loop 9” and “Loop 11” were advanced in the vicinity of the site. In general, boring Loop 5 is in the vicinity of Area A, Loop 9 is in the vicinity of Areas B and C and Loop 11 is near Area D. Information from these borings indicates that the soil profile typically consists of 10 to 20 feet of very loose to medium dense fill overlying a 30- to 70-foot-thick layer of very loose to medium dense alluvium mostly consisting of silty sand. Very dense glacially consolidated deposits are indicated below the alluvium in the borings. Based on Cross Section II-II’ of the Hart Crowser publication, depth to glacially consolidated soil is about 50 feet bgs in Areas A, B and C, and about 110 feet bgs in Area D.

SUBSURFACE CONDITIONS

General

We consider the subsurface conditions encountered in our 2008 explorations to be generally consistent with the existing information obtained from our review. For the purposes of this report, we classify the subsurface materials into three general units: 1) Soil fill, 2) Wood debris fill and 3) Native alluvium. For our use in preparing pressure diagrams for the temporary sheet pile wall design, we assumed certain layer thicknesses and engineering soil properties. These assumptions are provided on Table 1. Detailed descriptions of the subsurface soil conditions are provided in the following sections.

Based on our review and 2008 geotechnical explorations, we interpret groundwater at the site to be tidally influenced and generally present near the levels indicated on the Groundwater Elevation Contour Maps in Appendix C. Recent depth-to-groundwater measurements from monitoring wells installed in 2004 borings are provided in Appendix D, Table D-1. Detailed descriptions of site groundwater conditions are provided in the following sections. For a detailed understanding of site groundwater conditions, including specific information regarding tidal influence, we recommend that our 2007 environmental report be reviewed.

Soil Conditions

Interim Action, 2004

On average, excavations performed during the 2004 interim action extended to approximately 12 to 13 feet bgs. Conditions exposed in the excavation sidewalls generally consisted of 2 to 5 feet of soil fill overlying 5 to 10 feet of wood debris. Underlying the wood debris, the base of the excavation generally exposed native alluvial soils consisting of sand and silty sand.

Final Remedial Investigation/Feasibility Study, 2007

Based on our review of the boring logs included in the 2007 study (environment borings performed in 2004), we interpret the soil fill and wood debris to extend from the asphalt/gravel surface to depths of between approximately 10 and 13 feet bgs. Below the soil fill and/or wood debris fill, we interpret the native alluvium material to extend to the depths explored.

Geotechnical Explorations, 2008

At our exploration locations (GT-1, GT-2, CPT-1, CPT-2), we interpret the soil fill unit to extend from the asphalt/gravel surface to depths of between approximately 3 and 6 feet bgs. Below the soil fill unit, we interpret the wood debris fill unit to extend to depths of between approximately 10 and 12 feet bgs. Below the wood debris fill unit, we interpret the native alluvium unit to extend to the depths explored. Detailed descriptions of our 2008 field explorations, laboratory testing and summary exploration logs are presented in Appendix E.

Groundwater Conditions

Interim Action, 2004

Groundwater conditions encountered during the 2004 interim action excavation activities varied significantly due to encountering a damaged stormwater line within the excavation. This stormwater line and its pipe bedding material were observed to act as a conduit between the excavation and the adjacent Thea Foss Waterway. The following points summarize our understanding of groundwater encountered during the 2004 interim action:

- Groundwater was typically encountered during excavation at depths ranging from 6 to 10 feet bgs.
- In the most severe case, the water level inside the excavation varied by 4 to 8 feet due to tidal influence. This high variability in water level was attributed to effects of the “conduit” described above.
- At its highest point, the water level in the excavation reached 4 feet bgs.
- Water was pumped from the excavation on a daily basis to facilitate excavation, fill placement and compaction.

Final Remedial Investigation/Feasibility Study, 2007

Groundwater information provided in our 2007 environmental report is complex, and most of the information is beyond the considerations of this geotechnical study. We have excerpted relevant information from the 2007 study, which has been included in the Appendices of this report. Our general understanding of site groundwater levels as a result of our review is as follows:

- We expect site groundwater levels are near the elevations shown on the Groundwater Elevation Contour Maps, Appendix C.

- We expect that tidal influence on site groundwater level is on the order of 1 to 2 feet, when not influenced by direct conduits to adjacent bodies of water.

Geotechnical Explorations, 2008

Groundwater was encountered during drilling in explorations GT-1 and GT-2 at depths of 12 and 8 feet bgs, respectively.

CONCLUSIONS AND RECOMMENDATIONS

GENERAL

Based on our review of the existing site subsurface information and results of our 2008 geotechnical explorations, it is our opinion that the proposed remedial excavation is generally feasible from a geotechnical standpoint, provided that the recommendations presented in this report are incorporated into design and construction.

We have developed earth pressure diagrams and provided them to the structural engineer for use in the design of temporary cantilevered sheet pile walls. These diagrams, Case 1 and Case 2, are provided as Figures 6 and 7, respectively. In this report, we have included information developed by the structural engineer regarding minimum wall embedment, minimum sheet section thickness and anticipated wall deflection.

We anticipate that dewatering within the excavation will be needed to advance the excavation to the target depth of 12 feet bgs, and to facilitate structural fill placement and compaction. However, dewatering will not be utilized outside of the excavation footprint due to environmental considerations. General considerations for dewatering inside the excavation are discussed in the “Excavation Dewatering” section of this report.

Based on our understanding of the site subsurface soil and groundwater conditions, we anticipate the following will be required to complete the proposed excavation. Slope protection will be needed to maintain temporary slopes. Rock spalls or crushed rock will be needed to elevate the subgrade surface above the water table to facilitate structural fill placement and compaction. Sheet pile wall embedment could be compromised by overexcavating at the base of the wall, resulting in increased wall deflection; to address this we recommend the use of a rock spall toe buttress. These concerns are further discussed in the following sections of this report.

SITE PREPARATION AND EARTHWORK

General

We anticipate that site preparation and earthwork will include removing pavements as needed, relocating and/or protecting utilities, installing sheet pile wall sections, cutting back temporary excavation slopes, implementing temporary erosion controls specified on the plans, excavating, dewatering, placing rock spalls or crushed rock inside the excavation to a level above the water table, and placing and compacting structural fill. We expect that most of the site grading can be accomplished with conventional earthmoving equipment in proper working condition. Recommendations for earthwork, site development and fill materials are presented in the following sections.

Subgrade Preparation, Evaluation and Protection

We recognize that the site soils exposed in the base of the excavation are unlikely to be compacted into an unyielding condition because of their high fines content and likely submerged condition. Therefore, we

recommend rock spalls or crushed rock be placed in the base of the excavation to advance the subgrade elevation above the water table and facilitate structural fill placement and compaction. We recommend that the subgrade surface and rock placement be observed by a member of our firm prior to placement of structural fill.

Existing Utilities

Numerous above and below ground utilities are currently located within or near the proposed excavation locations. In addition, several utilities have been abandoned in place including portions of the former oil pipeline and numerous underground storage tanks (USTs). The utilities shown on Figures 2 through 5 have been approximately located by methods such as public/private utility locate service, survey of existing monuments and historic data. The locations should be considered approximate and field verified by the contractor prior to beginning work. The utilities within or near the proposed excavation will need to be supported during construction or relocated.

Excavation Support

Excavations deeper than 4 feet should be shored or laid back at a stable 2H:1V slope if workers are required to enter. Shoring for utility excavations must conform to the provisions of Title 296 Washington Administrative Code (WAC), Part N, "Excavation, Trenching and Shoring." Regardless of the soil type encountered in the excavation, shoring or sloped sidewalls will be required under the Washington Industrial Safety and Health Act (WISHA). Although this report describes certain approaches to excavation, the contract documents should specify that the contractor is responsible for selecting excavation methods, monitoring the excavations for safety and providing shoring, as required, to protect personnel and adjacent structures. Additional recommendations for excavation support are provided in the "Temporary Slopes" and "Sheet Pile Wall" sections of this report.

Temporary Slopes

General

For planning purposes, we recommend that temporary slopes be inclined no steeper than 2H:1V. This inclination is provided as an average over the proposed 12-foot-deep excavation and does not account for substantial erosion and undercutting due to unprotected slopes. This guideline assumes that all surface loads are kept at a minimum distance of at least one-half the depth of the cut away from the top of the slope. Where such slopes are not practical, temporary shoring should be used to protect workers and equipment. Ultimately, because the contractor has control over the excavation, it is their responsibility to provide safe working conditions on and around slopes.

Slope Protection and Erosion Control

Temporary slopes should be protected from erosion and disturbance. Based on the construction sequences in the 2004 Interim Action, it is our opinion that the most effective way to protect temporary slopes is to immediately cover/buttress the slope face with crushed rock or rock spalls. Alternatively, covering the slopes with steel plates/sheets would help reduce erosion, raveling and construction disturbance, and may provide confinement of the sloped material.

It is the responsibility of the contractor to protect the slopes from erosion. Without proper erosion protection, it should be assumed that the fluctuating water levels will erode the temporary slopes, eventually requiring the top of slope to be moved back to maintain a temporary 2H:1V slope. If erosion is not controlled, shoring may ultimately be needed. We recommend that bids submitted by contractors include specific methods proposed for slope protection and erosion control.

FILL MATERIALS

General

The suitability of material used as fill will depend on the gradation and moisture content of the soil. As the amount of fines (material passing the U.S. No. 200 sieve) increases, soil becomes increasingly sensitive to small changes in moisture content, and adequate compaction becomes more difficult, if not impossible, to achieve. We recommend that select structural fill or crushed rock be used as structural fill during the rainy season (typically October through May). The following sections summarize the material requirements for fill and backfill.

Structural Fill

Structural fill should be used as backfill material for the proposed excavations once the subgrade elevation has been brought above the prevailing groundwater table using rock spalls or crushed rock. Many soil types can be considered for use as structural fill during periods of dry weather, provided they are properly moisture-conditioned and free of roots, organic matter and other deleterious materials and do not contain particles larger than 8 inches in diameter. However, due to the high groundwater levels on this site we recommend extreme caution be used when attempting to use any structural fill material with more than 5 percent fines content by weight.

We do not anticipate an on-site source of structural fill will be available for this project; the project targets removal of contaminated soil. We anticipate that the selection of structural fill material will be subject to the environmental constraints associated with the project.

Select Structural Fill

Select structural fill should consist of imported, well-graded sand, sandy gravel or crushed rock with a maximum particle size of 3 inches and less than 5 percent passing a U.S. No. 200 sieve based on the minus ¾-inch fraction. This material should be free of organic matter, debris and other deleterious material. Select structural fill used during periods of prolonged dry weather may have up to 10 percent passing a U.S. No. 200 sieve.

Crushed Rock

Crushed rock fill should consist of clean, durable, crushed angular rock that has a maximum particle size of 2 inches, should be well graded between coarse and fine sizes and should have less than 5 percent fines (material passing a U.S. No. 200 sieve). Crushed rock should generally conform to shoulder ballast as defined in 9-03.9(2) of the Washington State Department of Transportation (WSDOT) "Standard Specifications for Road, Bridge and Municipal Construction," 2008. Crushed rock should be crushed to have at least two fractured faces. Crushed rock fill should be free of organic matter, debris and other deleterious material.

Ballast (Rock Spalls)

Rock spall material should consist of clean, durable, angular rock that has a maximum particle size gradation of 2 to 8 inches. This material is typically ordered in 2- to 4-inch or 4- to 8-inch gradation. Rock spalls should be free of organic matter, debris and any material less than 2 inches in size.

STRUCTURAL FILL PLACEMENT AND COMPACTION

Prior to structural fill placement, the subgrade surface should be elevated above the groundwater table by placing rock spalls or crushed rock, compacted in place using the bucket of an excavator. We anticipate that the thickness of the rock layer will be variable and depend on the effectiveness of dewatering measures, as discussed in the “Excavation Dewatering” section of this report.

Structural fill should be compacted at a moisture content near optimum. The maximum allowable moisture content varies with the soil gradation and should be evaluated during construction. Clayey soils and other fine granular soils can be difficult or impossible to compact during persistent wet conditions.

Structural fill material should be placed in uniform, horizontal lifts and uniformly densified with vibratory compaction equipment. The maximum lift thickness will vary depending on the material, compaction equipment used and required degree of compaction, but it should generally not exceed 10 inches in loose thickness for structural fill.

We recommend that structural fill be compacted to at least 95 percent of the maximum dry density (MDD) estimated in general accordance with American Society for Testing and Materials (ASTM) Test Method D 1557 (modified Proctor).

Settlement Considerations

If some settlement of structural fill is acceptable, structural fill more than 2 feet below planned pavements should be compacted to at least 90 percent of the MDD. The magnitude of settlement after the remedial excavations have been backfilled will depend on the type of structural fill material used, percentage of the MDD achieved, the effectiveness of the rock spall material in providing an unyielding subgrade, and the composition of material in the base of the excavation.

In general, we anticipate that settlement resulting from areas backfilled utilizing 90 percent compaction at depth would not exceed the likely on-going settlement of adjacent areas underlain by the wood debris fill unit. We are available to discuss pavement and pavement performance expectations with the respective property owners on a case-by-case basis, if requested.

SHEET PILE WALL

General

We have prepared earth pressure diagrams for the KPFF’s use in developing wall sections and minimum embedment lengths. We also provided KPFF with LPILE soil parameters for use in estimating wall deflection. The soil parameters used in our analyses and provided to KPFF are provided in Table 1.

In the following sections, we discuss earth pressure diagrams, information developed by the structural engineer and construction issues. The wall location, embedment depth requirement, section thickness and construction procedures should be in accordance with the final plans and specifications.

Earth Pressures on the Sheet Pile Wall

Our analysis assumed two design scenarios, Case 1 and Case 2. The differences are wall height, differential hydrostatic pressure, traffic surcharge loading and the sloping conditions above the wall. Resultant soil pressure diagrams and assumed geometry are shown in Figures 6 and 7.

Our selection of soil parameters is based on our review, explorations, laboratory test results, experience and judgment. The soil parameters used in our analyses are provided below on Table 1.

Table 1. Soil Parameters Used for Pressure Diagrams and Provided for LPILE Analysis

Soil Type 1) Per This Report 2) Per LPILE	Depth Range bgs (feet)	LPILE K Value (pci)	C, Cohesion (psf)	Friction Angle (degrees)	Active Earth Pressure Coefficient. Ka	Passive Earth Pressure Coefficient. Kp	Moist Unit Weight (pcf)	Wet Unit Weight (pcf)
1) Soil Fill 2) Sand	0 to 4	N/A	0	32	0.307	N/A	105	N/A
1) Wood Debris Fill 2) Sand	4 to 12	N/A	0	32	0.307	N/A	80	85
1) Alluvium 2) Sand	12 and below	15	0	30	0.333	3.00	N/A	110

Notes:

pci = pounds per cubic inch
psf = pounds per square foot
Ka and Kp are unitless
pcf = pounds per cubic foot

Seismic Considerations

It is our opinion that the probability of a seismic event occurring when the full wall height is exposed is low. We do not know how long the wall will be exposed; however, we expect that it will be on the order of months, not years. Therefore, because of the temporary condition of the sheet pile wall, the soil parameters above and resultant pressure diagrams do not consider seismic loads. Should seismic design parameters be needed, we are available to provide supplemental consultation.

Shoring Wall Alignment Considerations

For temporary sheet pile shoring wall installation, we have assumed a minimum horizontal setback distance from existing structures equal to the excavation depth. Our earth pressure diagram analyses did not take into account surcharge loads that might be induced by structures. If sheet pile walls are to be placed closer than the recommended setback distances indicated on Figure 4, or if surcharge loads exceed those stated on Figures 6 and 7, wall bracing should be anticipated. This may include tiebacks, internal bracing, toe buttress methods and staged excavations.

Pile Embedment and Deflection

Information developed by the structural engineer indicates that minimum sheet sizes of AZ 25 and AZ 12 will be required, for Case 1 and Case 2, respectively. We understand that minimum embedment depths are 35 and 24 feet below the base of excavation for Case 1 and Case 2, respectively. Thus, minimum sheet lengths of 47 and 36 feet are anticipated.

Based on the above sheet sizes, specified minimum embedment and LPILE soil parameters we provided, deflections at the top of the wall of 2.0 to 3.0 and 1.25 to 2.0 inches have been estimated by the structural engineer for Cases 1 and 2, respectively.

We consider these deflections conservative given that the analyses assumed a large, permanent uneven distribution of hydrostatic pressure, as indicated on Figures 6 and 7. Elevated water within the excavation, structural fill placement and the recommended rock spall toe buttress discussed below should reduce the actual deflection.

Construction Considerations

General

We anticipate that the sheet piles can be driven to the design embedment using a vibratory or impact hammer. The contractor should be prepared to handle obstructions, particularly within the wood debris fill. Appendix A of this report presents several photographs from the 2004 Interim Action that, to the best of our knowledge, represent the general makeup of the wood debris fill unit.

Even though the results of our review and subsurface explorations indicate reasonably consistent soil conditions along the wall alignment, it is possible that driving conditions may vary. Therefore, some contingency should be included in the project construction budget for variations in driving behavior that may impact driving time (for example, encountering large buried wood, concrete or other debris).

The water level behind the sheet pile walls should not be allowed rise above that shown on Figures 6 and 7 (4 and 6 feet bgs in Figures 6 and 7, respectively). Accordingly, we recommend that weep holes be cut in the face of some of the sheet piles. The selected contractor should propose specific methods in their design for maintaining the groundwater level behind sheet pile walls.

The layout of the sheet pile walls is provided on Figure 4. Placement is intended to maximize removal of contaminated soil while not endangering the foundations of neighboring buildings. Under no circumstances should the sheet piles be placed closer to a building than the depth of excavation, 12 feet, as indicated on Figure 4.

Excavation Dewatering

Based on the groundwater conditions encountered during the 2004 Interim Action and information provided in our 2007 report, we expect that tidal effects will result in fluctuating water levels inside the excavation. We anticipate that the magnitude of tidal influence will depend on the presence of preferential pathways/conduits between the excavation and adjacent water surfaces such as the Thea Foss Waterway. At a minimum, we anticipate water levels will fluctuate on the order of 1 to 2 feet.

Our observations from the 2004 interim action excavation suggest that 4 feet of standing water inside the excavation is the upper limit in which a contractor can work. Accordingly, and based on site grades and anticipated groundwater levels, we anticipate dewatering will be needed to drop the water level inside the excavation by 4 feet on average. Additional dewatering could potentially reduce the thickness of the rock spall/crushed rock layer recommended to bring the subgrade surface above the water level. We anticipate additional dewatering may be needed in excavations that encounter conduits to adjacent bodies of water.

Rock Spall Toe Buttress

After sheet pile installation, excavations in front of the sheet pile wall should be limited to 10-foot-wide sections when excavating deeper than 9 feet bgs. The lower 3 feet of material inside the excavation (9 to 12 feet bgs) should be replaced with a rock spall toe buttress immediately after its excavation. This buttress should be a minimum of 3 feet high, level, and extend perpendicular to the wall face for at least 5 feet.

Vibrations Monitoring and Deflection Survey

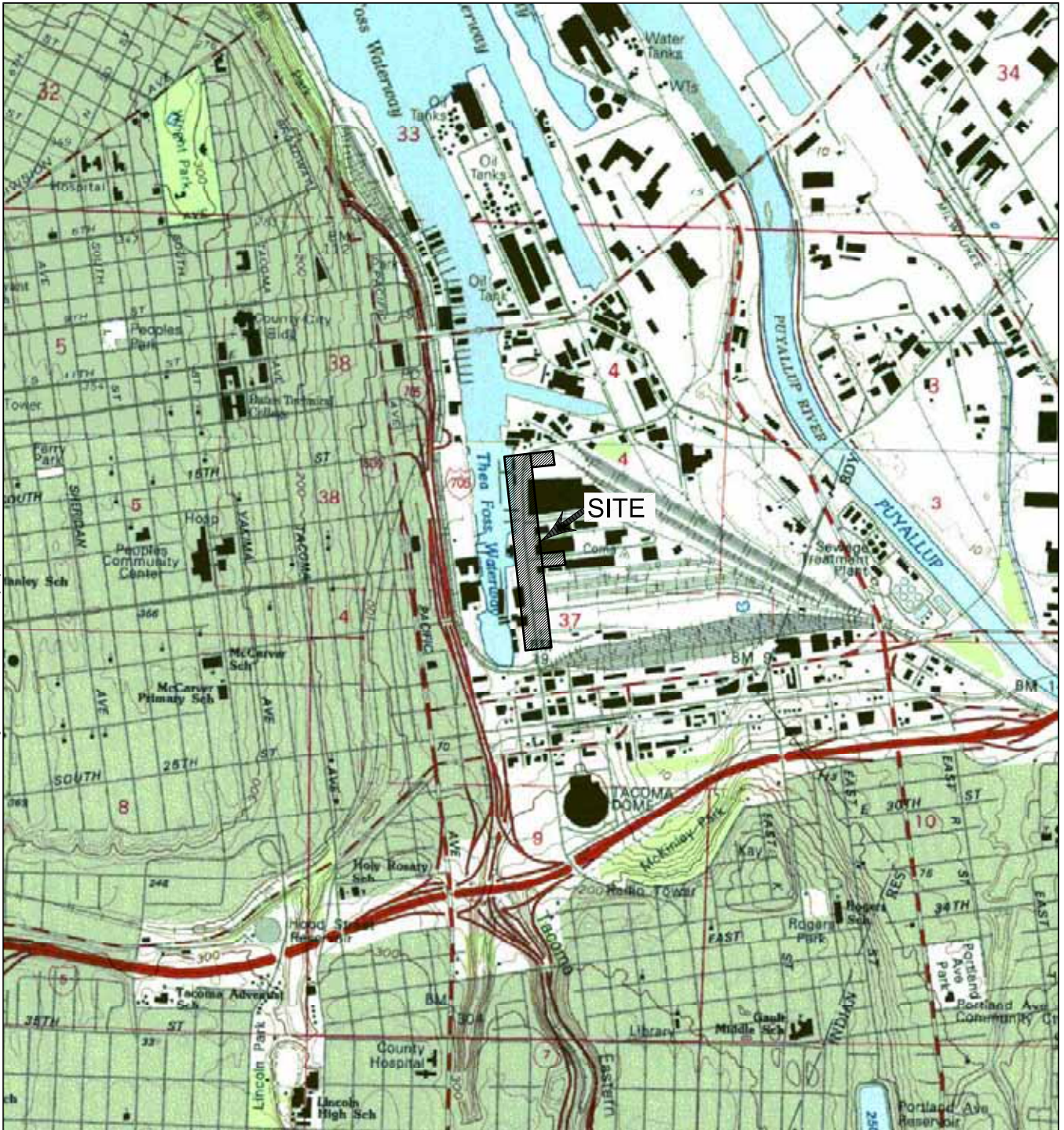
We recommend that a vibrations monitoring program be implemented to measure the vibration of adjacent structures and critical site features during sheet pile installation. We also recommend that survey points be set up on existing site features and on the sheet pile wall to measure potential deflection.

LIMITATIONS

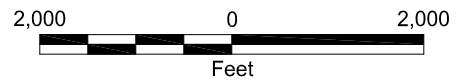
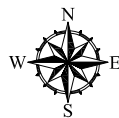
We have prepared this report for the exclusive use of BNSF Railway Company and their authorized agents for the oil pipeline remediation project in Tacoma, Washington.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practices in the field of geotechnical engineering in this area at the time this report was prepared. No warranty or other conditions, express or implied, should be understood.

Please refer to Appendix F titled “Report Limitations and Guidelines for Use” for additional information pertaining to use of this report.



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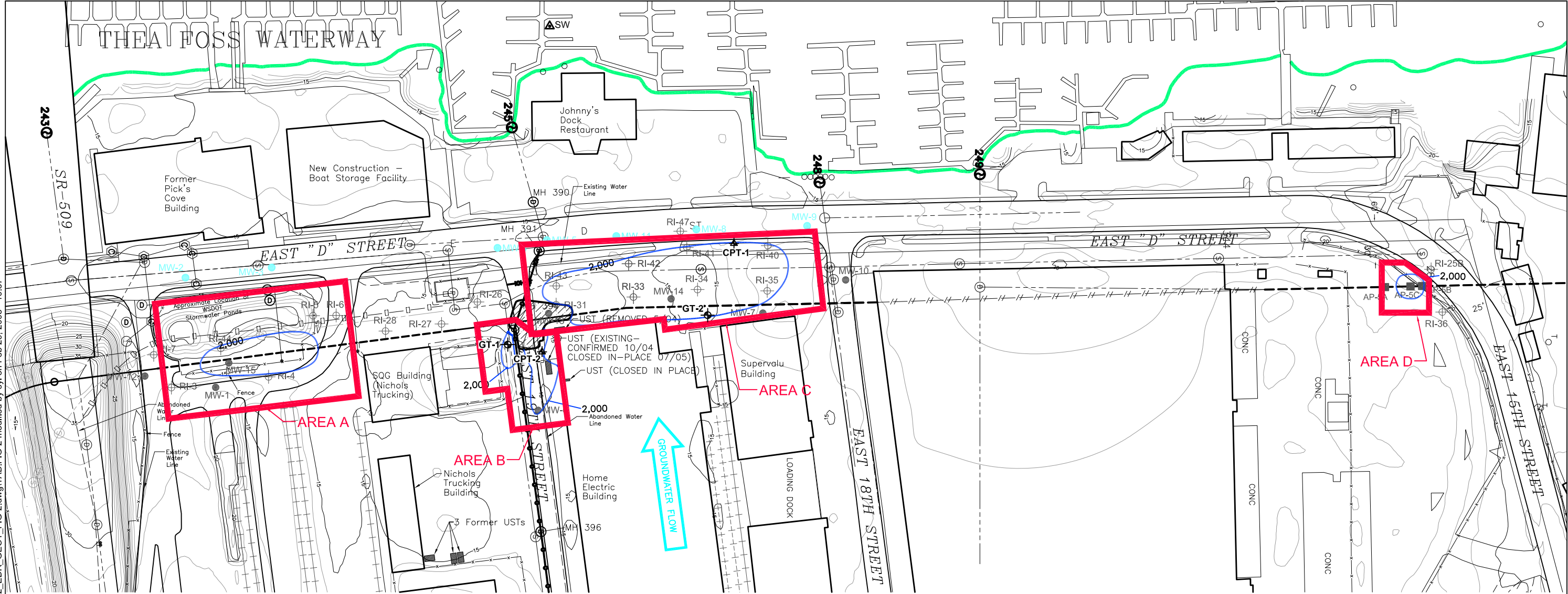
Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Reference: Sure Maps! Raster Maps- USGS based quadrangles.

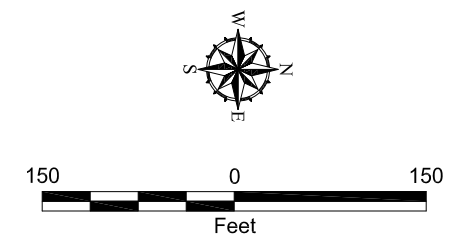
Vicinity Map Geotechnical Report	
BNSF Oil Pipeline Site (D Street) Tacoma, Washington	
GEOENGINEERS	Figure 1

P:\10050614\102\CAD\TSC\EDR\GEO\050614102_EDR_GEO_TFIG-2.dwg\TAB:FIG-2 modified by syr on Feb 29, 2008 - 10:37
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EXPLANATION:

- | | | | | | | | |
|--------------|--|-----------|---|--|---|--|-------------------------------|
| GT-1 | BORING NUMBER AND APPROXIMATE LOCATION | SW | STILLING WELL LOCATION | | THEA FOSS SHORELINE | | BRPH CONCENTRATIONS |
| CPT-1 | CONE PENETROMETER TEST NUMBER AND APPROXIMATE LOCATION | | STORMWATER OUTFALL | | LIMITS OF 2004 INTERIM REMEDIAL EXCAVATION | | 2,000 mg/kg |
| MW-1 | MONITORING WELL | | SEWER MANHOLE | | APPROXIMATE LIMITS OF PROPOSED REMEDIAL AREAS | | mg/kg MILLIGRAMS PER KILOGRAM |
| MW-5 | MONITORING WELL LOCATION AT THE CONDITIONAL POINTS OF COMPLIANCE | | CATCH BASIN | | | | |
| RI-42 | 2004 REMEDIAL INVESTIGATION BORING | | STORMWATER MANHOLE | | | | |
| AP-5A | 2002 PIPELINE ACCESS PIT | | HISTORIC PIPELINE ALIGNMENT | | | | |
| | | | PIPELINE REMOVED | | | | |
| | | | PIPELINE GROUTED IN PLACE | | | | |
| | | | SLIP-LINED STORM DRAIN | | | | |
| | | | STORM DRAIN HAS BEEN REPLACED | | | | |
| | | | ABANDONED 15-INCH PLASTIC SANITARY SEWER PIPE | | | | |



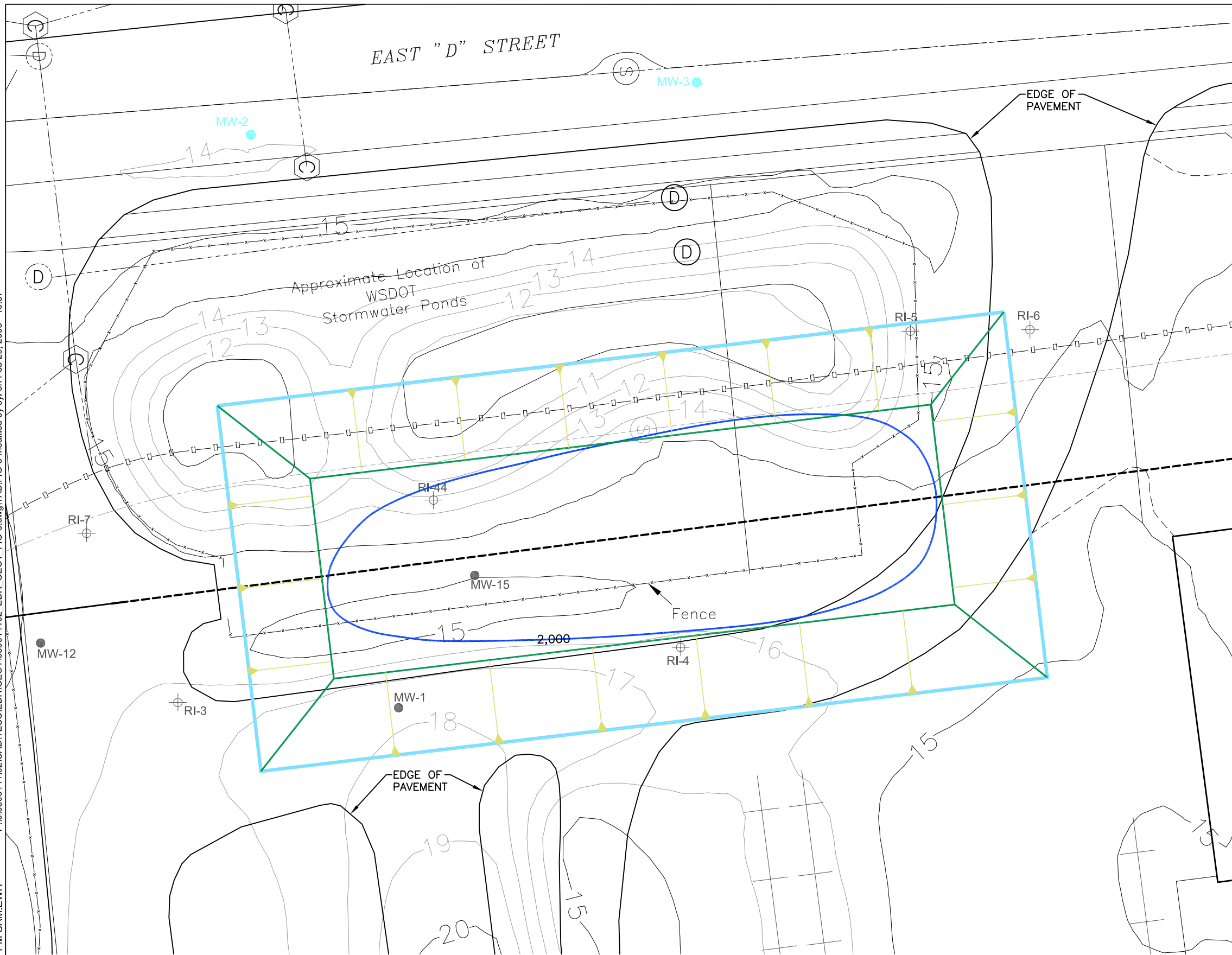
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Notes:
 1. The locations of all features shown are approximate.
 2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Reference: Drawing created from AutoCAD file, E.D st-oil line-b.DWG", provided by City of Tacoma.

Overall Site Plan Geotechnical Report	
BNSF Oil Pipeline Site (D Street) Tacoma, Washington	
GEOENGINEERS	Figure 2

P:\0050614102\CAD\TSC\EDR\GEO\050614102_EDR_GEO_TFIG-3.dwg\TAB:FIG-3 modified by syj on Feb 29, 2008 - 10:37
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- EXPLANATION:**
- MW-1 ● MONITORING WELL
 - MW-5 ● MONITORING WELL LOCATION AT THE CONDITIONAL POINTS OF COMPLIANCE
 - RI-42 ⊕ 2004 REMEDIAL INVESTIGATION BORING
 - ⊙ STORMWATER OUTFALL
 - ⊙ SEWER MANHOLE
 - ⊙ CATCH BASIN
 - ⊙ STORMWATER MANHOLE
 - HISTORIC PIPELINE ALIGNMENT
 - - - PIPELINE REMOVED
 - - - PIPELINE GROUTED IN PLACE
 - □ - □ - ABANDONED 15-INCH PLASTIC SANITARY SEWER PIPE
- BRPH CONCENTRATIONS**
- 2,000 mg/kg
 - mg/kg MILLIGRAMS PER KILOGRAM
 - SLOPED EXCAVATION - TOP OF SLOPE
 - EXCAVATION SLOPE
 - TOE OF EXCAVATION SLOPE

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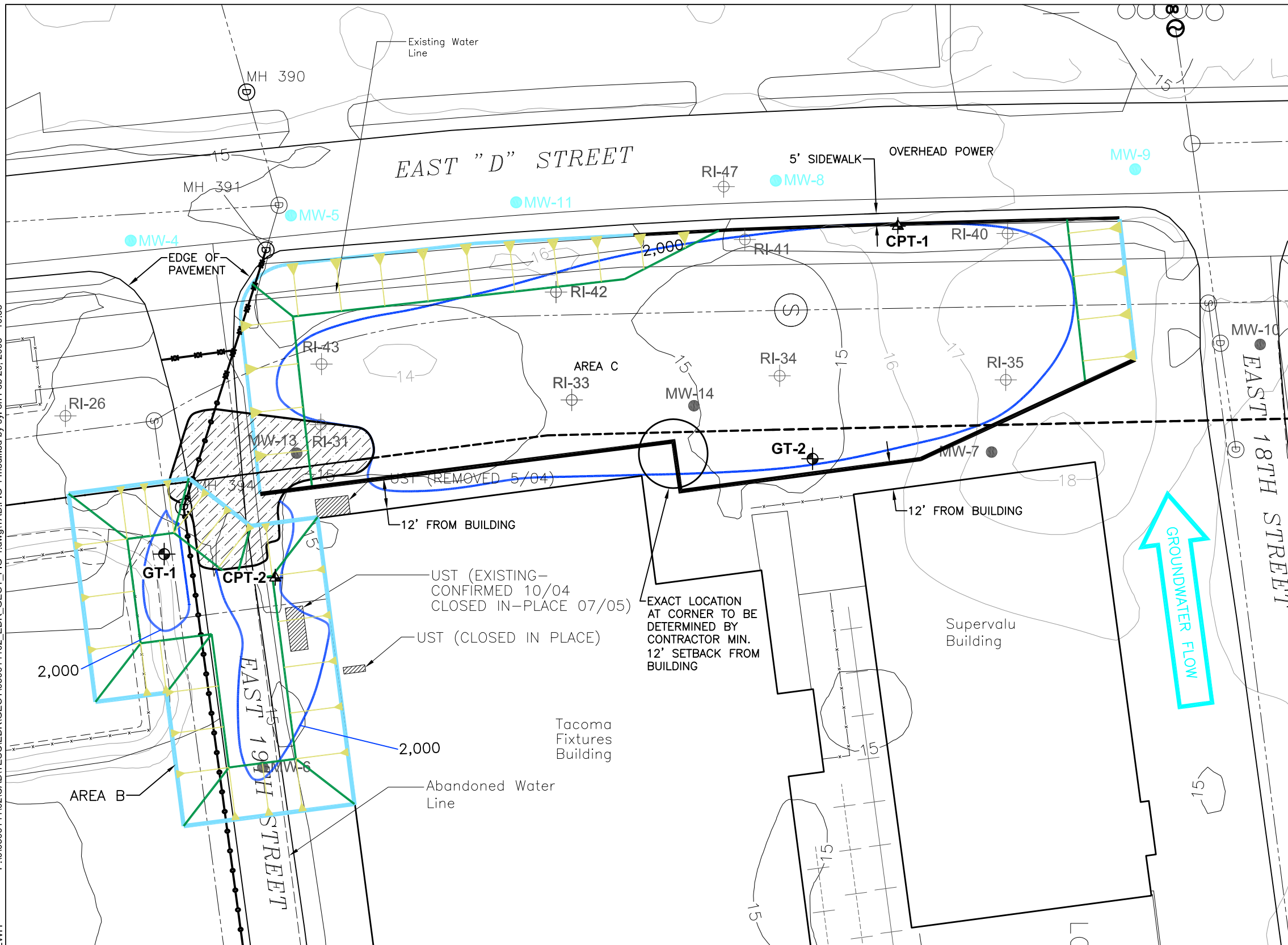
Site Plan - Area A Geotechnical Report	
BNSF Oil Pipeline Site (D Street) Tacoma, Washington	
GEOENGINEERS	Figure 3

Notes:

- The locations of all features shown are approximate.
- This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

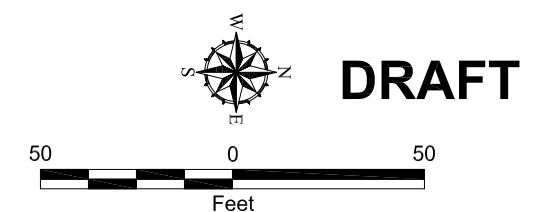
Reference: Drawing created from AutoCAD file, E.D st-oil line-b.DWG", provided by City of Tacoma.

P:\101050614\102\CAD\TIES\DRG\GEO\1050614\102_EDR_GEO_TFIG-4.dwg\TAB:FIG-4 modified by syj on Feb 29, 2006 - 10:38
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EXPLANATION:

- GT-1** BORING NUMBER AND APPROXIMATE LOCATION
- CPT-1** CONE PENETROMETER TEST NUMBER AND APPROXIMATE LOCATION
- MW-1** MONITORING WELL
- MW-5** MONITORING WELL LOCATION AT THE CONDITIONAL POINTS OF COMPLIANCE
- RI-42** 2004 REMEDIAL INVESTIGATION BORING
- STORMWATER OUTFALL
- SEWER MANHOLE
- CATCH BASIN
- STORMWATER MANHOLE
- HISTORIC PIPELINE ALIGNMENT
- PIPELINE REMOVED
- PIPELINE GROUTED IN PLACE
- SLIP-LINED STORM DRAIN
- STORM DRAIN HAS BEEN REPLACED
- ABANDONED 15-INCH PLASTIC SANITARY SEWER PIPE
- LIMITS OF 2004 INTERIM REMEDIAL EXCAVATION
- BRPH CONCENTRATIONS**
- 2,000 mg/kg
- mg/kg
- SLOPED EXCAVATION - TOP OF SLOPE
- EXCAVATION SLOPE
- TOE OF EXCAVATION SLOPE
- SHEET PILE WALL LOCATION



Site Plan - Areas B and C Geotechnical Report	
BNSF Oil Pipeline Site (D Street) Tacoma, Washington	
GEOENGINEERS	Figure 4

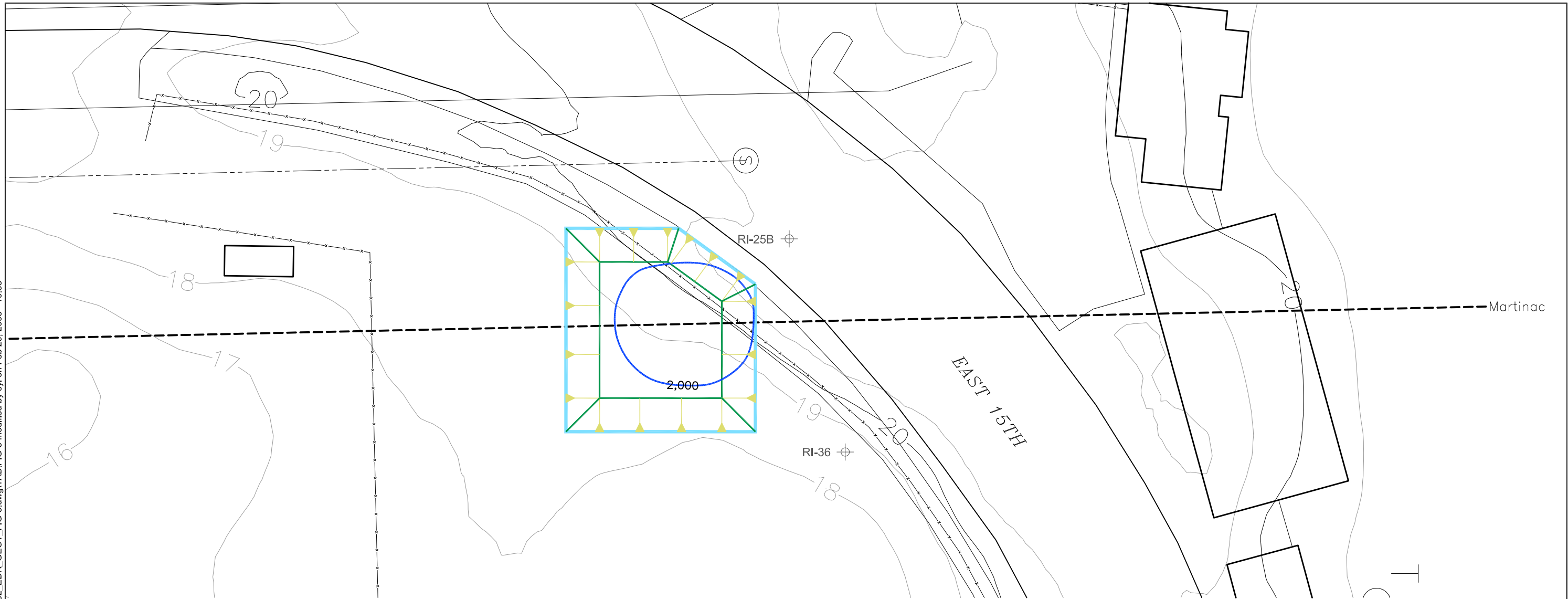
Notes:

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P:\0050614102\CAD\TSC\EDR\GEO\050614102_EDR_GEOT_FIG-5.dwg\TAB:FIG-5 modified by syj on Feb 29, 2006 - 10:38

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EXPLANATION:

-  SLOPED EXCAVATION - TOP OF SLOPE
-  EXCAVATION SLOPE
-  TOE OF EXCAVATION SLOPE

- BRPH CONCENTRATIONS
-  2,000 mg/kg
 - mg/kg MILLIGRAMS PER KILOGRAM

RI-41  2004 REMEDIAL INVESTIGATION BORING

 STORMWATER OUTFALL

 SEWER MANHOLE

 STORMWATER MANHOLE

 PIPELINE GROUTED IN PLACE

 PIPELINE PRESENCE UNKNOWN

- Notes:
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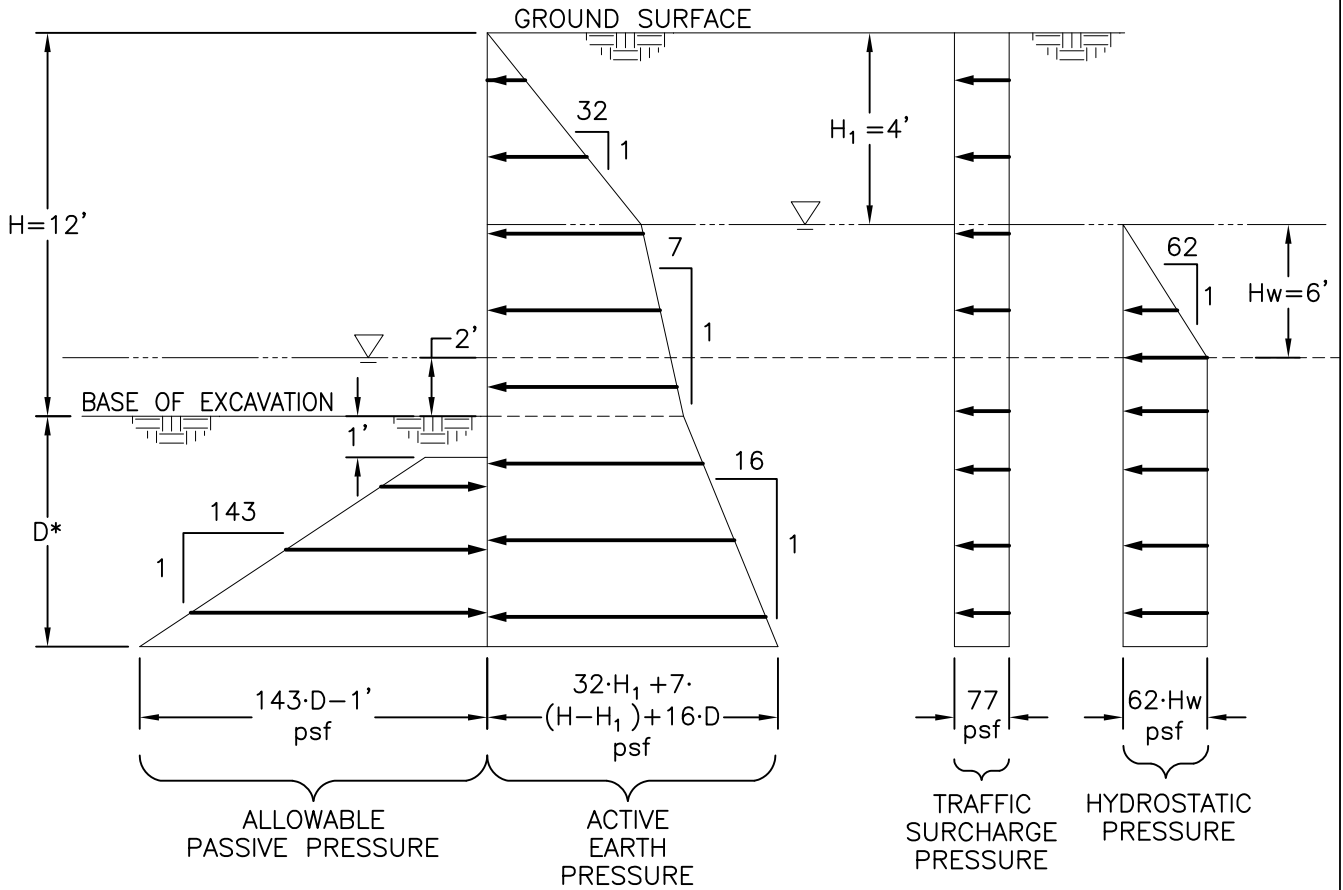
**Site Plan - Area D
Geotechnical Report**

BNSF Oil Pipeline Site (D Street)
Tacoma, Washington



Figure 5

TEMPORARY CANTILEVER SHEET PILE WALL



NOT TO SCALE

LEGEND:

- H = HEIGHT OF SHEET PILE WALL, FEET
- H_w = HEIGHT OF UNEVEN HYDROSTATIC PRESSURE, FEET
- H₁ = MINIMUM ALLOWABLE DEPTH TO GROUNDWATER, FEET
- *D = SHEET PILE EMBEDMENT, FEET, TO BE DETERMINED BY STRUCTURAL ENGINEER

DRAFT

Notes:

1. This pressure diagram is appropriate for temporary sheet pile walls. If additional surcharge loading (such as from soil stockpiles, excavators, dumptrucks, cranes, or concrete trucks) is anticipated, GeoEngineers should be consulted to provide revised surcharge pressures.

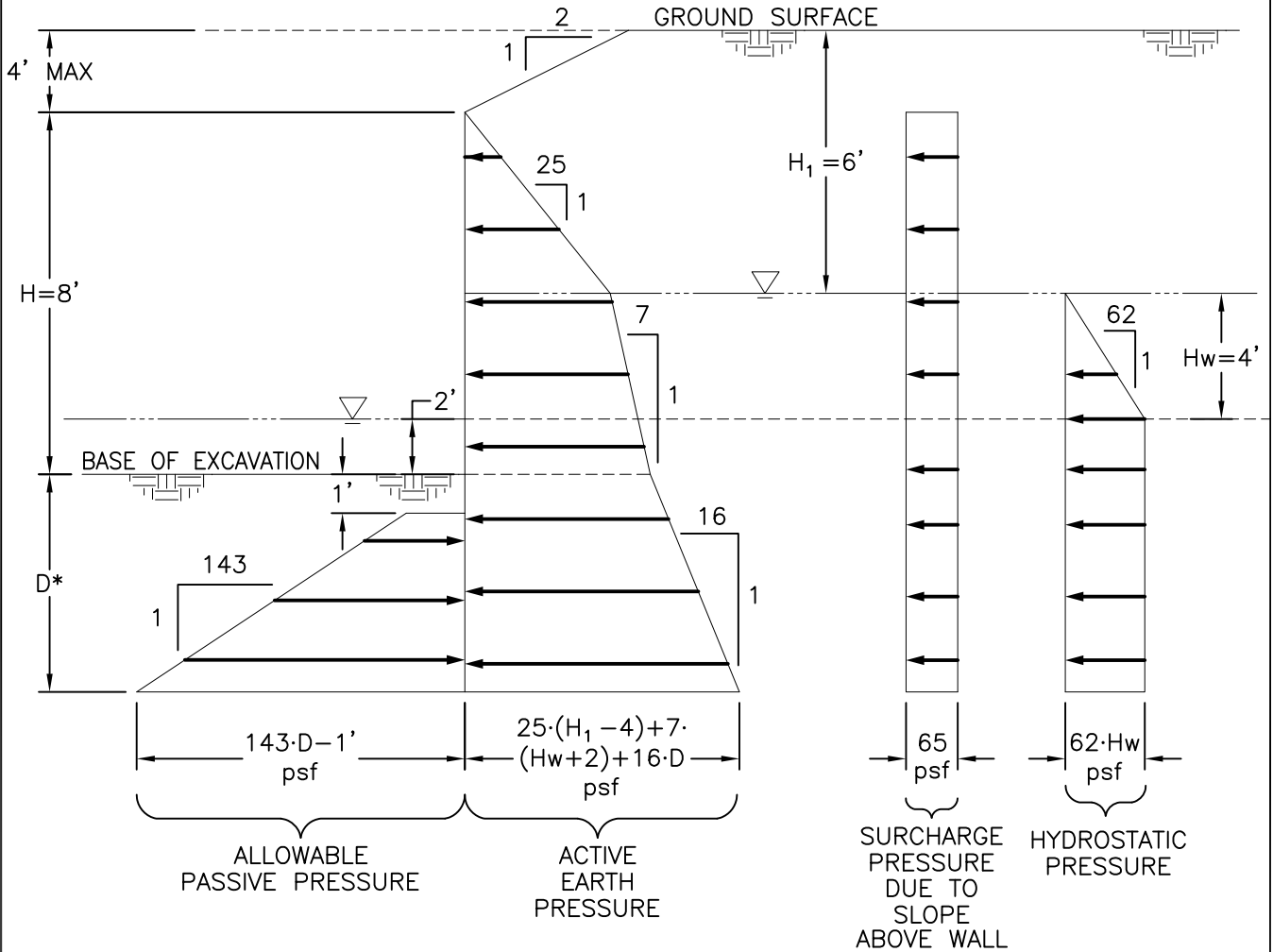
Earth Pressure Diagram (Case 1)

BNSF Oil Pipeline Site (D Street)
Tacoma, Washington

GEOENGINEERS 

Figure 6

TEMPORARY CANTILEVER SHEET PILE WALL



NOT TO SCALE

LEGEND:

- H = HEIGHT OF SHEET PILE WALL, FEET
- H_w = HEIGHT OF UNEVEN HYDROSTATIC PRESSURE, FEET
- H₁ = MINIMUM ALLOWABLE DEPTH TO GROUNDWATER, FEET
- *D = SHEET PILE EMBEDMENT, FEET, TO BE DETERMINED BY STRUCTURAL ENGINEER

DRAFT

Notes:

1. This pressure diagram is appropriate for temporary sheet pile walls. If additional surcharge loading (such as from soil stockpiles, excavators, dumptrucks, cranes, or concrete trucks) is anticipated, GeoEngineers should be consulted to provide revised surcharge pressures.

Earth Pressure Diagram (Case 2)

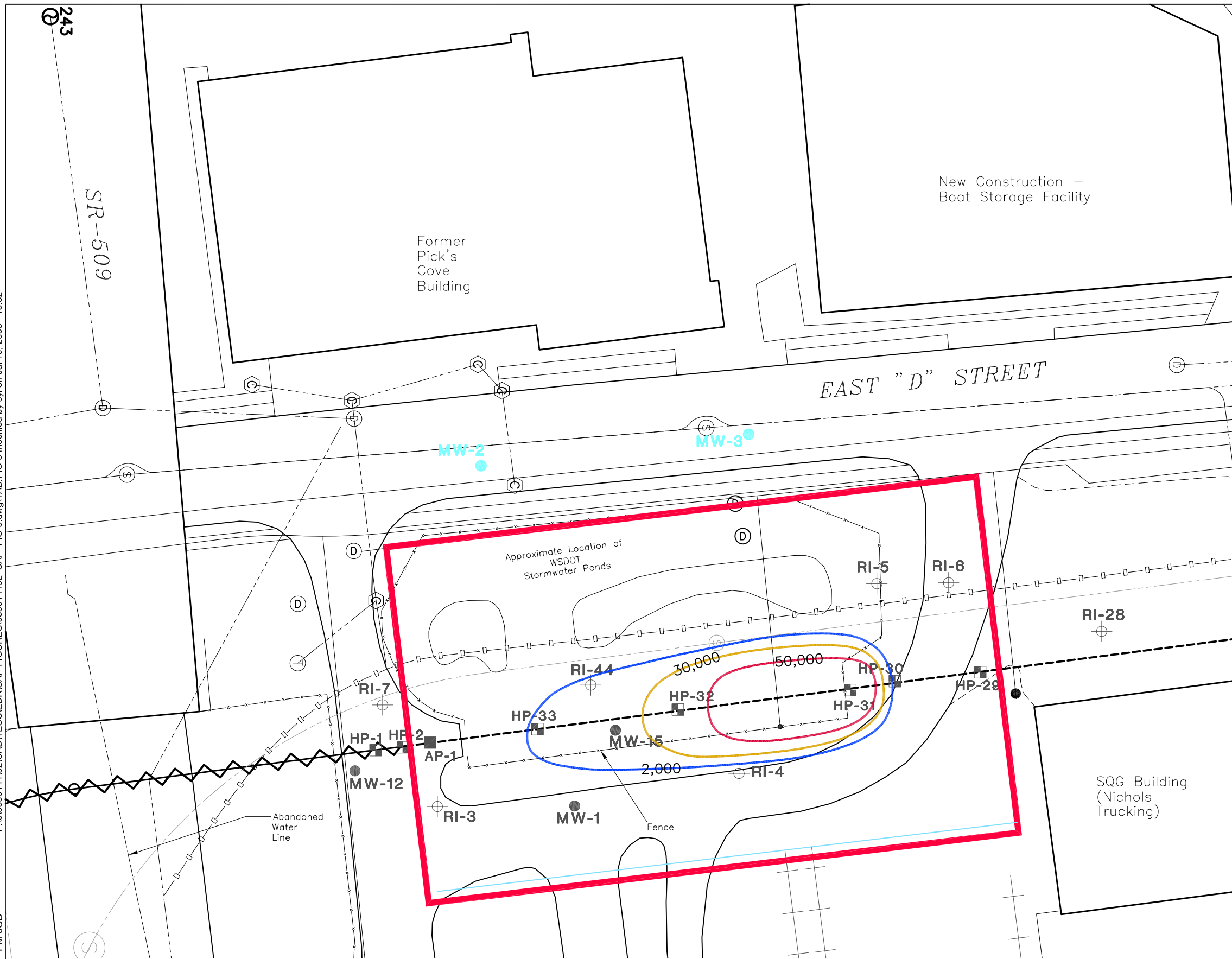
BNSF Oil Pipeline Site (D Street)
Tacoma, Washington

GEOENGINEERS

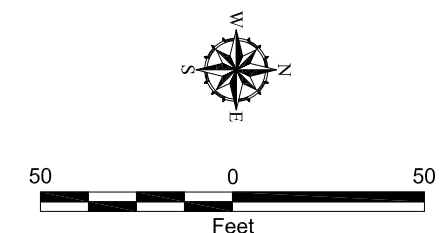
Figure 7

P:\10050614\102\CAD\TSC\EDR\SAP FIGURES\1050614\102_SAP_FIG-3.dwg/TAB:FIG-3 modified by syj on Jul 10, 2008 - 15:32

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- EXPLANATION:**
- MW-1** ● MONITORING WELL
 - MW-5** ● MONITORING WELL LOCATION AT THE CONDITIONAL POINTS OF COMPLIANCE
 - RI-42** ⊕ 2004 REMEDIAL INVESTIGATION BORING
 - 25** ● SOIL SAMPLE BY OTHERS
 - HP-31** ■ 2002 BORING
 - AP-1** ■ 2002 PIPELINE ACCESS PIT
 - SWA** ▲ STILLING WELL LOCATION
 - ⊙ STORM WATER OUTFALL
 - Ⓢ SEWER MANHOLE
 - ⓐ CATCH BASIN
 - Ⓧ STORM WATER MANHOLE
 - HISTORIC PIPELINE ALIGNMENT
 - ⚡ PIPELINE REMOVED
 - - - PIPELINE GROUTED IN PLACE
 - □ - □ - □ - ABANDONED 15-INCH PLASTIC SANITARY SEWER PIPE
- BRPH CONCENTRATIONS**
- 2,000 mg/kg
 - 30,000 mg/kg
 - 50,000 mg/kg
 - mg/kg MILLIGRAMS PER KILOGRAM
- APPROXIMATE LIMITS OF REMEDIAL AREAS**
-



Notes:

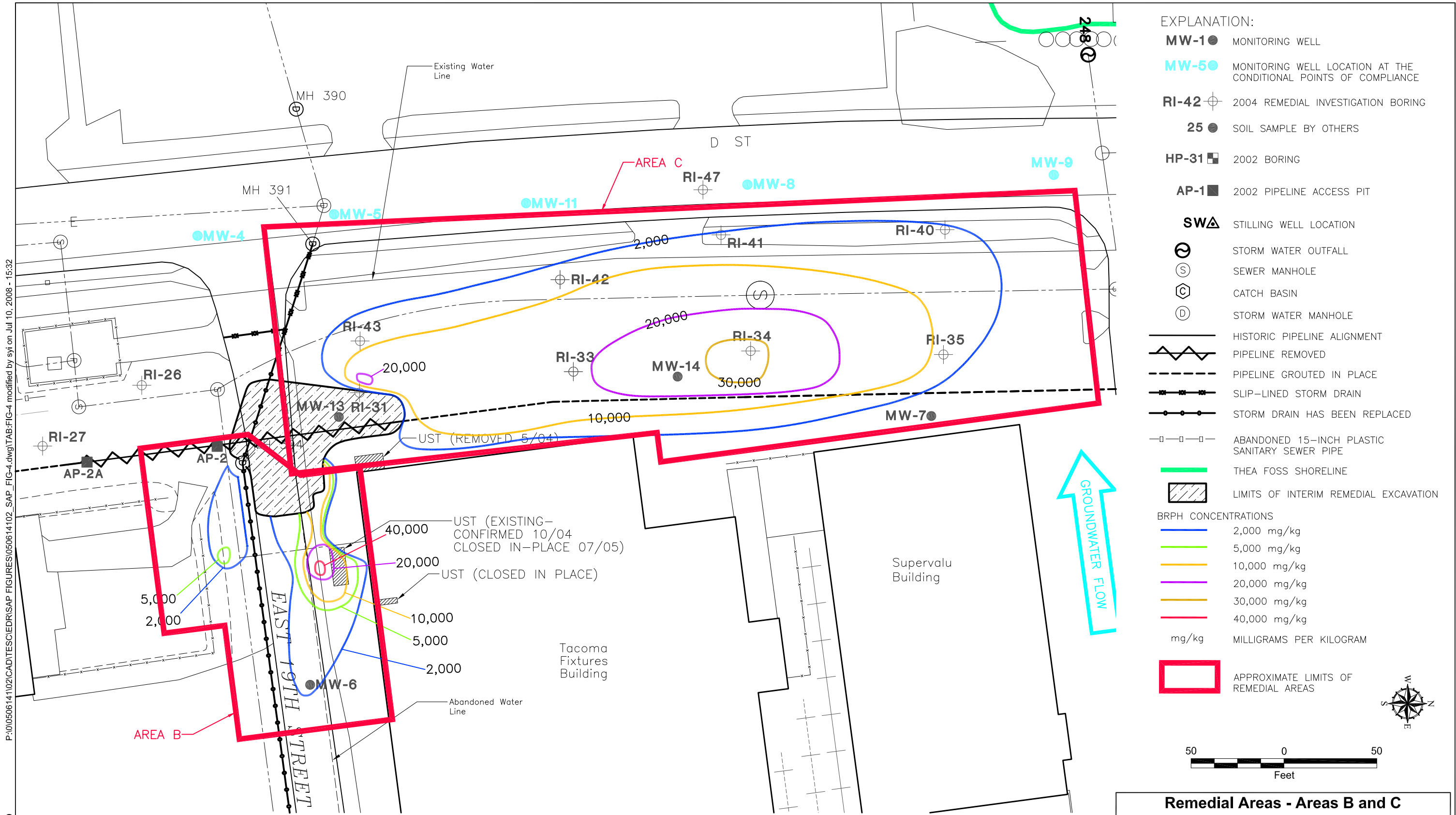
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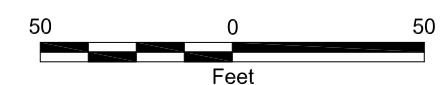
**Remedial Area - Area A
Sampling and Analysis Plan**

BNSF Oil Pipeline Site (D Street)
Tacoma, Washington

GEOENGINEERS **Figure 3**



- EXPLANATION:**
- MW-1** ● MONITORING WELL
 - MW-5** ● MONITORING WELL LOCATION AT THE CONDITIONAL POINTS OF COMPLIANCE
 - RI-42** ⊕ 2004 REMEDIAL INVESTIGATION BORING
 - 25** ● SOIL SAMPLE BY OTHERS
 - HP-31** ■ 2002 BORING
 - AP-1** ■ 2002 PIPELINE ACCESS PIT
 - SWA** ▲ STILLING WELL LOCATION
 - ⊙ STORM WATER OUTFALL
 - ⊙ S SEWER MANHOLE
 - ⊙ C CATCH BASIN
 - ⊙ D STORM WATER MANHOLE
 - HISTORIC PIPELINE ALIGNMENT
 - PIPELINE REMOVED
 - - - PIPELINE GROUTED IN PLACE
 - SLIP-LINED STORM DRAIN
 - STORM DRAIN HAS BEEN REPLACED
 - ABANDONED 15-INCH PLASTIC SANITARY SEWER PIPE
 - THEA FOSS SHORELINE
 - ▨ LIMITS OF INTERIM REMEDIAL EXCAVATION
- BRPH CONCENTRATIONS**
- 2,000 mg/kg
 - 5,000 mg/kg
 - 10,000 mg/kg
 - 20,000 mg/kg
 - 30,000 mg/kg
 - 40,000 mg/kg
- mg/kg MILLIGRAMS PER KILOGRAM
- ▭ APPROXIMATE LIMITS OF REMEDIAL AREAS



**Remedial Areas - Areas B and C
Sampling and Analysis Plan**

BNSF Oil Pipeline Site (D Street)
Tacoma, Washington

GEOENGINEERS **Figure 4**

P:\0050614\102\CAD\TSC\EDR\SAP FIGURES\050614\102_SAP_FIG-4.dwg/TAB:FIG-4 modified by syj on Jul 10, 2008 - 15:32
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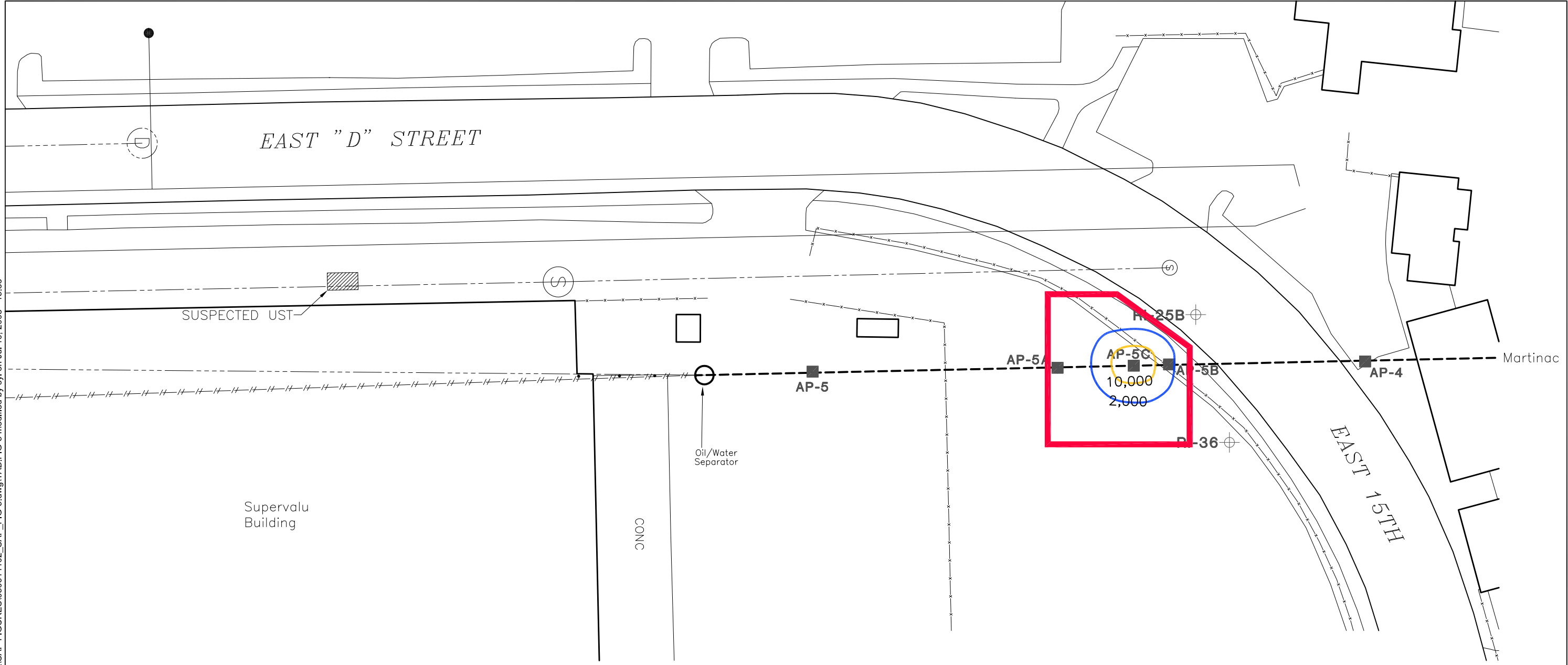
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P:\0050614102\CAD\TSC\IEDR\SAP FIGURES\050614102_SAP_FIG-5.dwg/TAB:FIG-5 modified by syj on Jul 10, 2008 - 15:33

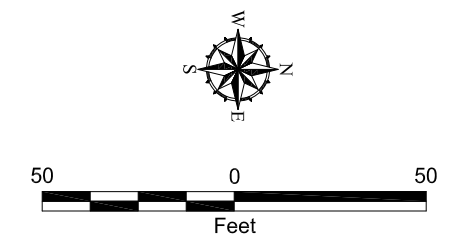
OFFICE:TACO PM JCD



EXPLANATION:

- BRPH CONCENTRATIONS
- 2,000 mg/kg
 - 10,000 mg/kg
- mg/kg MILLIGRAMS PER KILOGRAM
- APPROXIMATE LIMITS OF REMEDIAL AREAS

- RI-41 2004 REMEDIAL INVESTIGATION BORING
- AP-5C 2002 PIPELINE ACCESS PIT
- STORM WATER OUTFALL
- SEWER MANHOLE
- STORM WATER MANHOLE
- PIPELINE GROUTED IN PLACE
- PIPELINE PRESENCE UNKNOWN



Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Reference: Drawing created from AutoCAD file, E.D st-oil line-b.DWG", provided by City of Tacoma.

Remedial Area - Area D Sampling and Analysis Plan	
BNSF Oil Pipeline Site (D Street) Tacoma, Washington	
GEOENGINEERS	Figure 5



APPENDIX E
HEALTH AND SAFETY PLAN



**SITE HEALTH & SAFETY PLAN CHECKLIST
REMEDIAL EXCAVATION
BNSF OIL PIPELINE SITE
TACOMA, WASHINGTON**

JULY 9, 2008

**FOR
BNSF RAILWAY COMPANY**

PERSONNEL/CONTACT INFORMATION PHONE NUMBERS

TITLE	NAME	TELEPHONE NUMBERS
Site Safety and Health Supervisor	John Deeds	(253) 312-8626
Project Manager	Sally Fisher	(253) 431-2925
Health & Safety Program Manager	Leah Alcyon, CIH	(425) 861-6098
Field Engineer/Geologist	John Deeds	(253) 312-8626
Client	The BNSF Railway Company	
Current Owner	City of Tacoma, Home Electric, Nichols Trucking, SuperValu, WSDOT	

EMERGENCY INFORMATION

Hospital Name and Address St. Joseph Medical Center
 1717 South J Street
 Tacoma, Washington 98406
 (253) 426-4101

Route to Hospital Map:

- Drive south on East D Street**
- Turn right (west) on East 25th Street**
- Proceed west on 25th to Yakima Avenue**
- Turn right (north)**
- Proceed on Yakima to South 19th Street**
- Turn left (west)**
- Proceed on 19th Street to J Street**
- Turn right to access the St. Joseph emergency room.**



Ambulance: 9-1-1
Poison Control: Seattle (206) 253-2121; Other (800) 732-6985
Police: 9-1-1
Fire: 9-1-1
Location of Nearest Telephone: Cell phones are carried by field personnel.
Nearest Fire Extinguisher: Located in the GEI vehicle on site.
Nearest First-Aid Kit: Located in the GEI vehicle on site.

Standard Emergency Procedures

1. Get help -
 - send another worker to phone 911 (if necessary)
 - as soon as feasible, notify GeoEngineers' project manager
2. Reduce risk to injured person -
 - turn off equipment
 - move from injury location (if possible)
 - keep warm
 - perform CPR (if necessary)
3. Transport injured person to medical treatment facility (if necessary) -
 - by ambulance (if necessary) or GeoEngineers vehicle
 - stay with person at medical facility
 - keep GeoEngineers manager appraised of situation and notify human resources manager of situation

PERSONNEL TRAINING RECORDS

Name of Employee	Level of Training (24/ 40 hr)	Date of Last Training	HAZWOPER Supervisor Training	First Aid/ CPR	Respirator Fit Test
John Deeds	40 Hour	02/04/08	N/A	02/06/07	N/A

KNOWN (OR ANTICIPATED) HAZARDS

Note: A hazard assessment will be completed at every site prior to beginning field activities. Sections C14.6.1 to C14.6.8 list potential hazards and mitigation. The site hazard assessment checklist (see Section C14.6.9) identifies additional hazards observed during a site hazard reconnaissance and the appropriate mitigation measures. Updates will be included in the daily log. This list is a summary of hazards listed on the form.

Physical Hazards

<input type="checkbox"/>	Drill rigs
<input checked="" type="checkbox"/>	Backhoe
<input checked="" type="checkbox"/>	Trackhoe
<input type="checkbox"/>	Crane
<input checked="" type="checkbox"/>	Front End Loader
<input checked="" type="checkbox"/>	Excavations/trenching (1:1 slopes for Type B soil)
<input checked="" type="checkbox"/>	Shored/braced excavation if greater than 4 feet of depth
<input checked="" type="checkbox"/>	Overhead hazards/power lines
<input checked="" type="checkbox"/>	Tripping/puncture hazards (debris on-site, steep slopes or pits)
<input checked="" type="checkbox"/>	Unusual traffic hazard – Street traffic

Physical Hazard Mitigation Measures or Procedures

- Work areas will be marked with reflective cones, barricades and/or caution tape. Personnel will wear blaze orange vests for increased visibility by vehicle and equipment operators.
- Prior to placing equipment into service, the SSO will observe an equipment safety inspection by a trained and experienced equipment operator to ensure each piece of equipment meets standard equipment safety requirements. Equipment inspection records maintained by the owner and operator of the equipment at their office facility shall be made available to GeoEngineers upon request. Only experienced, proficient equipment operators will be used to operate heavy equipment. Personnel must possess the required operators' licensing or certification.
- Field personnel will be aware constantly of the location and motion of heavy equipment. A safe distance will be maintained between personnel and the equipment. Personnel will be visible to the operator at all times and will remain out of the swing and/or direction of the equipment apparatus. Personnel will approach operating heavy equipment only when they are certain the operator has indicated it is safe to do so.
- Heavy equipment and/or vehicles used on this site will not work within 50 feet of overhead utility lines without first ensuring that the lines are not energized.
- Personnel entry into unshored or unsloped excavations deeper than four feet is not allowed. Any trenching and shoring requirements will follow guidelines established in WAC 296-155, the Washington State Construction standards or OSHA 1926.651 Excavation Requirements. In the event that a worker is required to enter an excavation deeper than four feet, a trench box or other acceptable shoring will be employed or the sidewalls of the excavation will be sloped according to the soil type and guidelines as outlined in OSHA/WISHA regulations. If the shoring/sloping deviates from that outlined in the WAC, it will be designed and stamped by a PE. Prior to entry personnel will conduct air monitoring as described later in this plan. All hazardous encumbrances and excavated material will be stockpiled at least two feet from the edge of a trench or open pit. If concentrations of volatile gases accumulate within an open trench or excavation, the means of entering shall adhere to confined space entry and air monitoring procedures outlined under the air monitoring recommendations in this plan and the GeoEngineers Safety Program Manual.
- Personnel will avoid tripping hazards, steep slopes, pit and other hazardous encumbrances. If it becomes necessary to work within 6 feet of the edge of a pit, slope, pier or other potentially hazardous area, appropriate fall protection measures will be implemented by the SSO in accordance with OSHA/WISHA regulations and the GEI Safety Program manual.

Engineering Controls:

- Trench shoring (1:1 slope for Type B Soils)
- Location work spaces upwind/wind direction monitoring
- Visqueen/other soil covers (as needed)
- Other (specify) Erosion control measures

Chemical Hazards (Potentially present at site)

Petroleum Hydrocarbons:

- Naphthalenes or paraffins
- Aromatic hydrocarbons (benzene, ethylbenzene, toluene, xylenes)
- Gasoline
- Diesel fuel
- Waste oil
- Other petroleum fuels (list) _____

Hazards from Other Organic Compounds (Present or potentially present at site)

- Chlorinated hydrocarbons (Polychlorinated biphenyls) and PCE. Breakdown products of PCE have not been detected at the site.
- PAHs (polycyclic aromatic hydrocarbons)
- Pesticides/Herbicides
- Other _____

Metals (Potentially present at site)

- Lead
- Copper
- Chromium
- Zinc
- Other metals (see known chemical characteristics in Site History)

Known chemical characteristics (when contaminate have been detected)

	Soil Chemistry	Water Chemistry
TPH-D	53,300 mg/kg	0.515-2.87 µg/l
PAHs	>0.1 mg/kg	<0.1 µg/l

Chemical Hazard Mitigation Measures or Procedures

Air monitoring will be conducted for flammable vapors and for establishing the level of respiratory protection.

- Half face combination organic vapor/HEPA or P100 cartridge respirators will be available on site to be used as necessary. P100 cartridges are only to be used if PID measurements are below the site action limit. P100 cartridges are used for protection against dust, metals, asbestos, while the combination organic vapor/HEPA cartridges are protective against both dust and vapor. Ensure that the PID or TLV will detect the chemicals of concern on site.
- Level D PPE will be worn at all times on site. Potentially exposed personnel will wash gloves, hands, face, and other pertinent items to prevent hand-to-mouth contact. This will be done prior

to hand-to-mouth activities including eating, smoking, etc. Adequate personnel and equipment decontamination will be used to decrease potential ingestion and inhalation. Individual PELs or action limits are not expected to be exceeded given the planned activities. If there are waste oil contaminants in the soil and conditions are damp, airborne dust is not likely to be an issue. If conditions are dry and dust is visible during site activities, personnel will use P100 cartridges on their respirator.

Biologic Hazards

	Poison Ivy or other vegetation	
	Insects or snakes	
X	Used hypodermic needles or other infectious hazards	Do not pick up or contact
	Others	

Biologic Hazard Mitigation Measures or Procedures

Site personnel shall avoid contact with or exposures to potential biological hazards encountered.

Additional Hazards _____

Additional Hazards (Update in Daily Log)

Include evaluation of:

- Physical Hazards* (excavations and shoring, equipment, traffic, tripping, heat stress, cold stress and others)
- Chemical Hazards* (odors, spills, free product, airborne particulates and others present)
- Biologic Hazards* (snakes, spiders, other animals, discarded needles, poison ivy and others present)

LIST OF FIELD ACTIVITIES

Check the activities to be completed during the project

- Site reconnaissance
- Exploratory borings
- Construction monitoring
- Surveying
- Test pit exploration
- Monitor well installation
- Monitor well development
- Soil sample collection
- Field screening of soil samples
- Vapor measurements
- Groundwater sampling
- Groundwater depth and free product measurement
- Product sample collection
- Soil stockpile testing

- Remedial excavation
- Underground storage tank monitoring
- Remediation system monitoring
- Recovery of free product

SITE DESCRIPTION (Attach any additional site plan details and chemical analyses)

Site History

The site has historically been used for commercial and industrial purposes. A historic pipeline is located at the site as shown on the figures included with the site-specific work plans. The pipeline was used to transport fuel from bulk storage at East 15th Street to the Rail Yard located at approximately East D Street and East 21st Street. Previous investigations in the site area by GeoEngineers and others have indicated that petroleum hydrocarbons are present in soil beneath the Site at concentrations greater than MTCA Method A cleanup levels. The petroleum hydrocarbons are generally located in subsurface fills containing wood waste. Petroleum hydrocarbons may also be present in the surficial fill zone in some areas.

Address/Location: East "D" Street from East 21st Street to East 15th Street

Site Topography: Relatively flat

Predominant Wind Direction: _____

Site Drainage: _____

- Municipal drain
- Surface water drainage – If so, direction of flow west
- Engineered site drains
- Other-Erosion control measures

Utility Check Complete: To be completed prior to excavation

Traffic or Vehicle Access Control Plans: N/A

Site Access Control (exclusion zone) _____

Defined by: yellow caution tape

- Fence
- Survey tape
- Traffic cones
- Other (traffic control barriers as required by the city)

Hot Zone/Exclusion Zone (Define):

Personnel Protective Equipment

Minimum level of protective equipment for these sites is Level D. After the initial and/or daily hazard assessment has been completed, select the appropriate protective gear (PPE) to preserve worker safety. Task-specific levels of PPE shall be reviewed with field personnel during the pre-work briefing conducted prior to the start of site operations.

Check applicable personal protection gear to be used:

- Hardhat (if overhead hazards, or client requests)
- Steel-toed boots (if crushing hazards are a potential or if client requests)
- Safety glasses (if dust, particles, or other hazards are present or client requests)
- Hearing protection (if it is difficult to carry on a conversation 3 feet away)
- Rubber boots (if wet conditions)

Gloves (specify):

- Nitrile
- Latex
- Liners
- Leather
- Other (specify) _____

Protective Clothing:

- Tyvek (if dry conditions are encountered, Tyvek is sufficient)
- Saranex (personnel shall use Saranex if liquids are handled or splash may be an issue)
- Cotton
- Rain gear (as needed)
- Layered warm clothing (as needed)

Inhalation Hazard Protection:

- Level D
- Level C (respirators with organic vapor filters/ P100 filters)

Limitations of Protective Clothing

PPE clothing ensembles designated for use during site activities shall be selected to provide protection against known or anticipated hazards. However, no protective garment, glove or boot is entirely chemical-resistant, nor does any PPE provide protection against all types of hazards. To obtain optimum performance from PPE, site personnel shall be trained in the proper use and inspection of PPE. This training shall include the following:

- Inspect PPE before and during use for imperfect seams, non-uniform coatings, tears, poorly functioning closures, or other defects. If the integrity of the PPE is compromised in any manner, proceed to the contamination reduction zone and replace the PPE.
- Inspect PPE during use for visible signs of chemical permeation such as swelling, discoloration, stiffness, brittleness, cracks, tears or other signs of punctures. If the integrity of the PPE is comprised in any manner, proceed to the contamination reduction zone and replace the PPE.
- Disposable PPE should not be reused after breaks unless it has been properly decontaminated.

Respirator Selection, Use, and Maintenance

GeoEngineers has developed a written respiratory protection program in compliance with OSHA requirements contained in 29 CFR 1910.134. Site personnel shall be trained on the proper use, maintenance and limitations of respirators. Site personnel that are required to wear respiratory protection shall be medically qualified to wear respiratory protection in accordance with 29 CFR 1910.134. Site personnel that will use a tight-fitting respirator must have passed a qualitative or quantitative fit test conducted in accordance with an OSHA-accepted fit test protocol. Fit testing must be repeated annually or whenever a new type of respirator is used.

Respirator Cartridges

If site personnel are required to wear air-purifying respirators, the appropriate cartridges shall be selected to protect personnel from known or anticipated site contaminants. The respirator/cartridge combination shall be certified and approved by NIOSH. A cartridge change out schedule shall be developed based on known site contaminants, anticipated contaminant concentrations, and data supplied by the cartridge manufacturer related to the absorption capacity of the cartridge for specific contaminants. Site personnel shall be made aware of the cartridge change out schedule prior to the initiation of site activities. Site personnel shall also be instructed to change respirator cartridges if they detect increased resistance during inhalation or detect vapor breakthrough by smell, taste or feel although break though is not an acceptable method of determining the change out schedule. At a minimum, cartridges should be changed a minimum of once daily.

Respirator Inspection and Cleaning

The Site Safety Officer shall periodically (i.e., weekly) inspect respirators at the project site. Site personnel shall inspect respirators prior to each use in accordance with the manufacturer's instructions. In addition, site personnel wearing a tight-fitting respirator shall perform a positive and negative pressure user seal check each time the respirator is donned to ensure proper fit and function. User seal checks shall be performed in accordance with the GeoEngineers respiratory protection program or the respirator manufacturer's instructions.

Respirators shall be hygienically cleaned as often as necessary to maintain the equipment in a sanitary condition. At a minimum, respirators shall be cleaned at the end of each work shift. Respirator cleaning procedures shall include an initial soap/water cleaning, a water rinse, a sanitizing soaking and a final

water rinse. One capful of bleach per one gallon of water can be used to create the sanitizing soak solution. When not in use, respirators shall be stored to protect against damage, hazardous chemicals, sunlight, dust, excessive temperatures and excessive moisture. In addition, respirators shall be stored to prevent deformation of the face piece and exhalation valve.

Facial Hair and Corrective Lenses

Site personnel with facial hair that interferes with the sealing surface of a respirator shall not be permitted to wear respiratory protection or work in areas where respiratory protection is required. Normal eyeglasses cannot be worn under full-face respirators because the temple bars interfere with the sealing surface of the respirator. Site personnel requiring corrective lenses will be provided with spectacle inserts designed for use with full-face respirators. Contact lenses should not be worn with respiratory protection.

AIR MONITORING PLAN

Work upwind if at all possible.

Check instrumentation to be used:

- TLV Monitor (flammability only, for methane and petroleum vapors)
- PID (Photoionization Detector)
- Other (i.e., detector tubes): _____

Check monitoring frequency/locations: and type (specify: work space, borehole, breathing zone):

- 15 minutes - Continuous during soil disturbance activities or handling samples**
- 15 minutes
- 30 minutes
- Hourly (in breathing zone during excavations, drilling, sampling)

Additional personal air monitoring for specific chemical exposure:

Action Levels

- The workspace will be monitored using a PID (photoionization detector). These instruments must be properly maintained, calibrated and charged (refer to the instrument manuals for details). Zero this meter in the same relative humidity as the area it will be used in and allow at least a 10-minute warm-up prior to zeroing. Do not zero in a contaminated area. The PID can be tuned to read chemicals specifically if there are not multiple contaminants on site. Can tune to detect one chemical with response factor entered into equipment but PID picks up all Volatile Organic Compounds present. Ionization potential (IP) of chemical has to be less than lamp (11.7/ 10.6eV) and PID does not detect methane. The ppm readout on the instrument is relative to the IP of isobutylene (calibration gas) so conversion must be made in order to estimate ppm of chemical on site.
- An initial vapor measurement survey of the site should be conducted to detect “hot spots” if contaminated soil is exposed at the surface. Vapor measurement surveys of the workspace should be conducted at least hourly or more often if persistent petroleum-related odors are detected. Additionally, if vapor concentrations exceed 5 ppm above background continuously for a

5-minute period as measured in the breathing zone, upgrade to Level C PPE or move to a non-contaminated area.

- If the workspace will be monitored using a TLV Sniffer, the TLV Sniffer is not consistently reliable in measuring vapor concentrations less than 400 ppm. Therefore, the TLV Sniffer should be used only as a warning indicator of high vapor concentrations. A PID is the preferred instrument and will be used if work with gasoline-contaminated soil is conducted.
- If the TLV Sniffer indicates greater than 1,000 ppm at the borehole or 600 ppm in the breathing zone flammability may be a problem as well as indicating a health hazard. Stop work, move to an uncontaminated area and stabilize the situation. Continue work with caution, monitoring every 15 minutes.
- Standard industrial hygiene/safety procedure is to require that action be taken to reduce worker exposure to organic vapors when vapor concentrations exceed 1/2 the TLV. Because of the variety of chemicals, the PID will not indicate exposure to a specific PEL and is, therefore, not a preferred tool for determining worker exposure to chemicals. If odors are detected then employees will upgrade to a respirator with organic vapor cartridges and will contact the Health and Safety Program Manager for other sampling options.

AIR MONITORING ACTION LEVELS

Contaminant	Activity	Monitoring Device	Frequency of Monitoring Breathing Zone	Action Level	Action
Organic Vapors	Environmental Remedial Investigation	PID	Start of shift; prior to drilling; every 30 to 60 minutes and in event of odors	Background to 5 parts per million (ppm) in breathing zone	Use Level D or Modified Level D PPE
Organic Vapors	Environmental Remedial Investigation	PID	Start of shift; prior to drilling; every 30 to 60 minutes and in event of odors	5 to 25 ppm in breathing zone	Upgrade to Level C PPE
Organic Vapors	Environmental Remedial Investigation	PID	Start of shift; prior to drilling; every 30 to 60 minutes	>25 ppm in breathing zone	Stop work and evacuate the area. Contact CIH for guidance.
Combustible Atmosphere	Environmental Remedial Investigation	PID/TLV	Start of shift; prior to drilling; every 30 to 60 minutes	<10% LEL or <1000 ppm	Depends on contaminant. The PEL is usually exceeded before the LEL.
Combustible Atmosphere	Environmental Remedial Investigation	PID/TLV Or 4 gas meter	Start of shift; prior to drilling; every 30 to 60 minutes	>10% LEL or >1000 ppm	Stop work and evacuate the site. Contact CIH for guidance.

DECONTAMINATION PROCEDURES

Minimal decontamination consists of washing soiled boots, gloves and respirator; hands and face; discarding protective clothing; and removing used respirator cartridges prior to eating, drinking or leaving the site. *Used PPE to be placed in on-site drum.*

Specify other decontamination procedures:

WASTE DISPOSAL OR STORAGE

PPE disposal (specify): *To drums to be stored on-site pending characterization and disposal.*

Drill cutting/excavated sediment disposal or storage:

On-site, pending analysis and further action
 Secured (list method) _____
 Other (describe destination, responsible parties): Truck and box - Rabanco

DOCUMENTATION EXPECTED TO BE COMPLETED

Required Forms:

- Field Log
- Health and Safety Plan acknowledgment by GEI employees (Form C-2)
- Contractors Health and Safety Plan Disclaimer (Form C-3)
- Conditional forms available at GeoEngineers office: Accident Report (Form C-4)

NOTE: The Field Log is to contain the following information:

- Updates on hazard assessments, field decisions, conversations with subs, client or other parties
- Air monitoring/calibration results; personnel, locations monitored, activity at the time of monitoring
- Action level for upgrading PPE and rationale
- Meteorological conditions (temperature, wind direction, speed, humidity, etc.)

APPROVALS

1	Plan Prepared	_____	_____
		Signature	Date
2	Plan Approval	_____	_____
		PM Signature	Date
3	Health & Safety Officer	Leah Alcyon, CIH _____	July 9, 2008 _____
		Health & Safety Program Manager	Date

FORM C-2
SITE SAFETY PLAN – GEOENGINEERS’ EMPLOYEE ACKNOWLEDGEMENT

BNSF OIL PIPELINE SITE

FILE NO. 0506-141-02

(All GeoEngineers’ site workers complete this form, which should remain attached to the Safety Plan Checklist and filed with other project documentation).

I, _____, do hereby verify that a copy of the current Safety Plan has been provided by GeoEngineers, Inc., for my review and personal use. I have read the document completely and acknowledge a full understanding of the safety procedures and protocol for my responsibilities on site. I agree to comply with all required, specified safety regulations and procedures. I understand that I will be informed immediately of any changes that would affect site personnel safety.

Signed _____ Date _____

Range of Dates From: _____
To: _____

Signed _____ Date _____

Range of Dates From: _____
To: _____

Signed _____ Date _____

Range of Dates From: _____
To: _____

Signed _____ Date _____

**FORM C-3
SUBCONTRACTOR AND SITE VISITOR SITE SAFETY FORM**

BNSF OIL PIPELINE SITE

FILE NO. 0506-141-02

I, _____, verify that a copy of the current site Safety Plan has been provided by GeoEngineers, Inc. to inform me of the hazardous substances on-site and to provide safety procedures and protocols that will be used by GeoEngineers' staff at the site. If I choose to use GeoEngineers' site safety plan, I agree to do so on behalf of the undersigned company only at my own risk, and shall hold GeoEngineers harmless and indemnify it against all liability in the case of any injury or death. By accepting and using this site Safety Plan, I agree that the safety of my employees is the responsibility of the undersigned company.

Signed _____ Date _____

Firm: _____

Signed _____ Date _____

Firm: _____

Signed _____ Date _____

Firm: _____

Signed _____ Date _____

Firm: _____

Signed _____ Date _____

Firm: _____

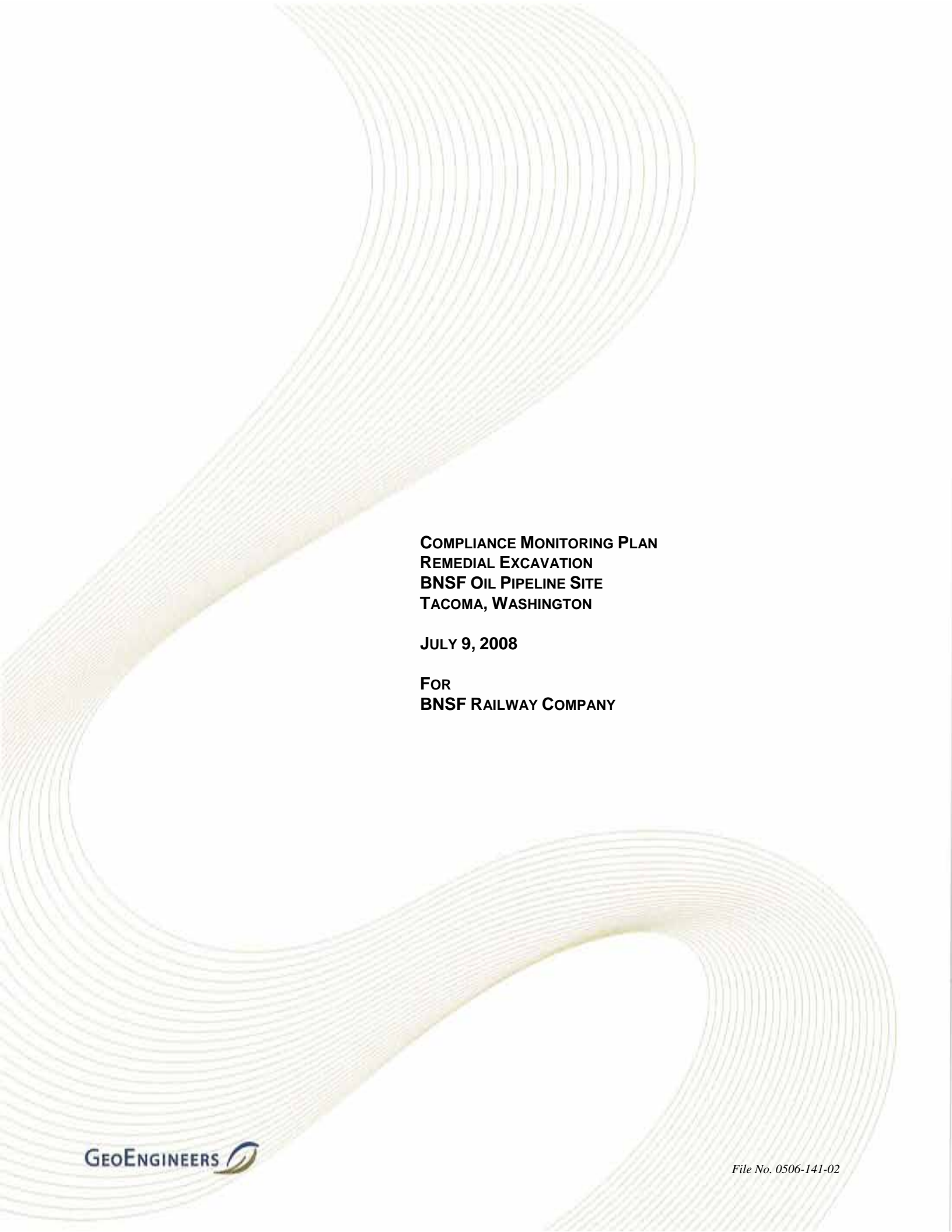
Signed _____ Date _____

Firm: _____



APPENDIX F
COMPLIANCE MONITORING PLAN





**COMPLIANCE MONITORING PLAN
REMEDIAL EXCAVATION
BNSF OIL PIPELINE SITE
TACOMA, WASHINGTON**

JULY 9, 2008

**FOR
BNSF RAILWAY COMPANY**

**Compliance Monitoring Plan
File No. 0506-141-02**

July 9, 2008

Prepared for:

**BNSF Railway Company
2454 Occidental Avenue South, Suite D
Seattle, Washington 98134**

Attention: Bruce Sheppard

Prepared by:

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**Tony C. Mathis, PE, LG, LHG
Environmental Engineer**



**Sally L. Fisher
Associate, Environmental Scientist**

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TABLE OF CONTENTS

	<u>Page No.</u>
1.0 INTRODUCTION.....	1
2.0 POINT OF COMPLIANCE	1
3.0 CONTAMINANTS OF CONCERN	2
4.0 SITE CLEANUP LEVELS	2
5.0 ANALYTICAL PROCEDURES.....	2
6.0 STATISTICAL ANALYSIS.....	3
7.0 SCHEDULE FOR COMPLIANCE MONITORING	3
8.0 REPORTING	3
9.0 CONTINGENCY PLAN	4
10.0 GROUNDWATER SAMPLING PROCEDURES.....	4
10.1 WATER LEVEL MEASUREMENT	4
10.2 GROUNDWATER SAMPLING.....	4
10.3 FIELD EQUIPMENT CALIBRATION PROCEDURES.....	5
11.0 SAMPLE HANDLING AND CUSTODY REQUIRMENTS.....	5
11.1 CUSTODY PROCEDURES	6
11.2 SAMPLE LABELING	6
12.0 DECONTAMINATION PROCEDURES	7
12.1 PERSONNEL	7
12.2 SAMPLING EQUIPMENT	7
13.0 PURGE WATER STORAGE AND DISPOSAL.....	7
14.0 QUALITY ASSURANCE/QUALITY CONTROL	7
14.1 QUALITY ASSURANCE OBJECTIVES.....	7
14.2 FIELD QA/QC PROCEDURES.....	7
14.2.1 Sample Preservation and Containers.....	7
14.3 LABORATORY QA/QC PROCEDURES	8
14.3.1 Equipment Calibration Procedures and Frequency	8
14.3.2 Analytical Procedures.....	8
14.3.3 Laboratory QA/QC Samples.....	8
14.3.4 Laboratory Deliverables.....	8
14.4 REVIEW OF FIELD AND LABORATORY QA/QC DATA	9
14.5 PRECISION, ACCURACY AND COMPLETENESS.....	9
14.5.1 Precision.....	9
14.5.2 Accuracy.....	9
14.5.3 Completeness.....	10
14.6 REPORTING, DOCUMENTATION, DATA REDUCTION AND CORRECTIVE ACTION.....	10
15.0 REFERENCES.....	10

TABLE OF CONTENTS (CONTINUED)

Page No.

List of Tables

MTCA Cleanup Levels	2
Table 1. Sample Containers, Preservation and Holding Time	
Table 2. Data Quality Objectives	

List of Figures

Figure 1. Vicinity Map, Compliance Monitoring Plan	
Figure 2. Monitoring Well Locations, Compliance Monitoring Plan	

**COMPLIANCE MONITORING PLAN
REMEDIAL EXCAVATION
BNSF OIL PIPELINE SITE
TACOMA, WASHINGTON
FOR
BNSF RAILWAY COMPANY**

1.0 INTRODUCTION

This Compliance Monitoring Plan (CMP) describes groundwater compliance monitoring activities to be performed at the BNSF Railway Company (BNSF) Oil Pipeline Site (Site) in Tacoma, Washington. This CMP has been prepared as an appendix to the Engineering Design Report (EDR) for the project and will be used in conjunction with the Health and Safety Plan (HASP), which is also being submitted as an appendix to the EDR.

The location of the Site is indicated on the Vicinity Map, Figure 1. The purpose of the remedial action is to remediate petroleum-contaminated soils in the vicinity of the former BNSF Oil Pipeline Site. Remedial excavation activities are described in detail in the EDR.

The purpose of this CMP is to describe the groundwater compliance monitoring activities to be conducted after the remedial construction. The CMP will identify monitoring well locations and describe the groundwater sampling frequency, groundwater sampling equipment and procedures, recommended chemical analytical methods and general field activity protocols that will be used during groundwater monitoring activities at the Site. This CMP also identifies quality assurance/quality control (QA/QC) procedures and methods for evaluating the analytical data. This CMP was prepared in general accordance with the Model Toxics Control Act (MTCA), Washington Administrative Code (WAC) 173-340-410 and WAC 173-340-820.

2.0 POINT OF COMPLIANCE

The point of compliance (POC) for groundwater is generally considered to be the point or points where the groundwater cleanup level (CUL) must be attained for the Site to be in compliance with the cleanup standards. The standard POC for groundwater is generally considered to be any point within the Site boundaries.

Conditional points of compliance (CPOCs) can be used if it is not practical to achieve the CUL within all areas of the Site within a reasonable restoration time frame. Because it will not be practicable to remove all contaminated soil at the Site, groundwater could remain impacted in the vicinity of those areas where contaminated soil is left in place. For these reasons, a CPOC has been selected that is close to the source areas, but outside of the areas where groundwater impacts have generally been observed. The CPOC at the Site has been identified as the existing wells within the East "D" Street right-of-way (ROW) in the Remedial Investigation/Feasibility Study (RI/FS) (GeoEngineers 2007, Section 10.1.2). The existing wells within the East "D" Street ROW include MW-2, MW-3, MW-4, MW-5, MW-8, MW-9 and MW-11 (the "D" Street wells), as shown in Figure 2. With proper monitoring, this CPOC should prove to be protective of the Thea Foss Waterway.

3.0 CONTAMINANTS OF CONCERN

Bunker-range petroleum hydrocarbons (BRPH)¹ and carcinogenic polycyclic aromatic hydrocarbons (cPAHs) have been detected in soil and groundwater beneath portions of the Site during subsurface investigations and pipeline closure activities. The chemical analytical data for petroleum hydrocarbons (including BRPH) and cPAHs in soil and groundwater samples obtained during the RI/FS and during previous investigations at the Site were evaluated relative to the selected cleanup criteria to evaluate the nature and extent of contamination at the Site. Based on this evaluation, the primary contaminants of concern (COCs) for both soil and groundwater are BRPH and cPAHs.

BRPH in soil is the primary COC at the Site. Other COCs (that is, cPAHs in soil and BRPH and cPAHs in groundwater) are also present at the Site and are associated with the BRPH in soil. Remedial actions at the Site are, therefore, focused on control and recovery of BRPH.

4.0 SITE CLEANUP LEVELS

MTCA Method A CULs have been selected for soil and groundwater at the Site. The following table presents the applicable groundwater CULs identified in the RI/FS.

MTCA Cleanup Levels

Contaminant of Concern	Applicable Criteria	Concentration
BRPH in groundwater	MTCA Method A	0.5 mg/L
Naphthalene in groundwater	MTCA Method B	160 µg/L
Total cPAHs ¹ in groundwater	MTCA Method A	0.1 µg/L (total)

Notes:

¹ Calculated using toxicity equivalency factor methodology per WAC 173-340-708(8) and WAC 173-340-900, Table 740-1.

mg/L = milligrams per liter

µg/L = micrograms per liter

Surface water criteria are not applicable to the Site as described in Section 7.4 of the RI/FS.

5.0 ANALYTICAL PROCEDURES

Groundwater sample analysis at the Site will be conducted to assess trends in the concentrations of COCs and to monitor natural attenuation parameters. Chemical analysis of groundwater samples for COCs will be performed using the following analytical procedures:

- Diesel- and oil-range petroleum hydrocarbons by NWTPH-Dx, calibrated to Bunker C, with silica gel cleanup; and
- cPAHs by U.S. Environmental Protection Agency (EPA) Method GC/MS for low detection limits.

Chemical analysis for natural attenuation parameters will include the following:

¹ BRPH is a site-specific term indicating a Bunker C petroleum product with both diesel- and oil-range petroleum hydrocarbons. The concentration of BRPH as discussed in this report indicates either: 1) the sum of the laboratory-reported concentrations of diesel- and oil-range petroleum hydrocarbons; or 2) the concentration of petroleum hydrocarbons quantified during analysis relative to a Bunker C product laboratory standard.

- Salinity by EPA Method 2520B;
- Manganese by EPA Method 200.8 with detection limits of 0.01 milligrams per liter (mg/L);
- Nitrates by EPA Method 300 with detection limits of 0.2 mg/L;
- Sulfates by EPA Method 300 with detection limits of 0.4 mg/L; and
- Total Alkalinity by EPA Method 310.1 with detection limits of 5.0 mg/L.

6.0 STATISTICAL ANALYSIS

Statistical analysis of chemical analytical results for groundwater samples from each monitoring well will be performed to assess whether the groundwater sample from that location meets the compliance criteria as described above in Section 4.0 of this CMP. The procedures are described in detail in Section 5.0 of the *Statistical Guidance for Ecology Site Managers, August 1992, Publication No. 92-54*, published by the Washington State Department of Ecology (Ecology).

Chemical analytical data for each groundwater sample will be assessed. If a primary and a duplicate sample are obtained from the monitoring well, the primary sample will be used to perform the statistical analysis. Historical information used for the estimation of the mean and median of the sample population will consist of analytical data collected during groundwater sampling events from 2004 to 2008.

Initial data evaluation will be performed to evaluate whether the concentrations of the COCs in a single sample are greater than two times the Site CULs presented in Section 4.0, and whether less than 10 percent of the chemical concentrations in groundwater exceed the CUL during a representative sampling period.

Statistical evaluation will be performed using the MTCASat tool to estimate the 95 percent upper confidence interval of the 50th percentile (the mean) of the data set using a one-tailed confidence interval. For the purposes of the statistical evaluation, it will be assumed that the data from each well are lognormally distributed. Detailed computational procedures are described in Section 5.2.1 of Ecology's *Statistical Guidance for Ecology Site Managers*.

7.0 SCHEDULE FOR COMPLIANCE MONITORING

Groundwater compliance monitoring will be performed on a quarterly basis until the remedial excavation has been completed, and then will occur annually at the Site for a period of 5 years.

8.0 REPORTING

A report describing the results of each annual sampling event will be submitted to Ecology within three months of the completion of each sampling event. The reports will contain the following:

- A summary of field activities during groundwater sampling;
- Validated chemical analytical results, and a copy of the analytical data validation report;
- A comparison of analytical results for BRPH and cPAHs with previous analytical results;
- A summary of the statistical analysis performed on the analytical data; and
- Recommendations.

9.0 CONTINGENCY PLAN

The following actions will be conducted if the groundwater monitoring results indicate that COCs are present at concentrations greater than the CUL at the CPOC (“D” Street wells).

- Resampling to verify analytical results
- Resuming quarterly groundwater sampling

If COCs are detected at concentrations greater than the CUL for two consecutive quarters, the following actions will be considered.

- Installing additional monitoring wells between East “D” Street and the Thea Foss Waterway;
- Investigating subsurface conditions in the area of concern;
- Discussing potential further actions with Ecology; and

Ecology will also conduct 5-year reviews of the monitoring scheme and data in accordance with WAC 173-340-420.

10.0 GROUNDWATER SAMPLING PROCEDURES

Groundwater compliance monitoring will consist of obtaining groundwater samples from the seven “D” Street wells. Field methodology will include measuring water levels, obtaining groundwater samples and submitting the samples to the laboratory.

10.1 WATER LEVEL MEASUREMENT

Water levels will be measured in each well using an electronic water level indicator prior to purging the well and obtaining groundwater samples. Measurements will be taken from the top of the well casing and recorded to the nearest 0.01 foot. The total well depth will also be recorded.

10.2 GROUNDWATER SAMPLING

Each monitoring well will be purged and groundwater samples will be obtained using low-flow sampling methodology to minimize sediment suspension in groundwater samples. Water quality parameters will not be collected from monitoring wells that contain visible free product; instead, three well volumes will be purged prior to sample collection. After measuring and recording the groundwater level, and evaluating for the presence of visible free product, the wells will be purged and sampled using a dedicated 2-inch-diameter submersible pump equipped with a discharge control valve. The pump intake will be located at the approximate center of the screened interval or the midpoint of the water column, whichever is deeper, of the monitoring well. A flow rate of 0.5 liters per minute or less will be maintained during monitoring well purging and sampling. Flow rates will be measured using a graduated cylinder and stopwatch.

Water quality parameters including temperature, pH, conductivity, turbidity, dissolved oxygen and reduction/oxidation potential will be measured at approximately 5-minute intervals during well purging. Monitoring wells generally will be considered purged when three consecutive temperature, pH and conductivity measurements are within 10 percent of each other and the turbidity is approximately 5 nephelometric turbidity units (NTUs) or less. However, during previous groundwater monitoring activities, conductivity of the purge water from monitoring wells in the tidally influenced area of the Site

did not equilibrate during purging in all cases. The changes in measured conductivity of groundwater from these monitoring wells are likely the result of the exchange of seawater and groundwater as the result of tidal fluctuations in the nearby waterway. In these cases, temperature, pH and turbidity measurements will be used to evaluate when purging is complete. Sample collection will occur immediately after purging is completed.

In cases where the 5 NTU turbidity purge criterion cannot be met within a reasonable time, the groundwater samples from the monitoring well will be obtained and the laboratory instructed to allow the sample to settle before extraction.

Groundwater will be transferred from the dedicated pump tubing directly to laboratory-supplied sampling containers. Samples for metals analysis will be field-filtered using dedicated 0.45-micron filters. The sample containers will be labeled in the field and stored in an iced cooler prior to and during shipment to the laboratory.

10.3 FIELD EQUIPMENT CALIBRATION PROCEDURES

Field equipment requiring calibration will be calibrated to known standards in accordance with manufacturers' recommended schedules and procedures for each instrument. Calibration checks of the instruments will be conducted daily, and the instruments will be recalibrated if required. Calibration measurements will be recorded in the daily field logs. If field equipment becomes inoperable, it will be replaced with a properly calibrated instrument.

11.0 SAMPLE HANDLING AND CUSTODY REQUIREMENTS

The following procedures will be used at all times when obtaining groundwater samples during the compliance monitoring activities.

- Dedicated nitrile gloves will be worn when obtaining groundwater samples.
- Groundwater samples obtained for chemical analysis will be placed into clean sample containers supplied by the analytical laboratory.
- One field duplicate sample will be obtained during each groundwater compliance monitoring sampling event. The well from which the field duplicate is obtained will be identified in the field during each sampling event, and will be a different well than that used from the duplicate sample from the preceding sampling event.
- Sufficient sample volume will be obtained for the laboratory to complete the method-specific quality control analyses on a laboratory-batch basis.
- Sample labels will be completed for each sample, following the procedures provided below in Section 11.2. Immediately after the samples are obtained, they will be stored in a cooler with ice until they are delivered to the analytical laboratory.
- Standard chain-of-custody procedures will be followed for all samples obtained. All samples will be submitted to the laboratory within 48 hours of collection.
- A 10-day turnaround time for analytical results will be requested from the laboratory.

11.1 CUSTODY PROCEDURES

Chain-of-custody procedures will be used to track the possession of the samples from the time they are obtained in the field through analysis and final disposition. Each time the samples change hands, both the sender and receiver will sign and date the chain-of-custody record form. A chain-of-custody record form will be used to track possession of the samples and to document the analyses requested. The form will be completed at the end of each sampling day prior to transfer of samples off site and will accompany the samples during shipment to the laboratory.

When the samples are shipped to the laboratory via common carrier, one copy of the chain-of-custody record form will be retained for project files, and the remaining copies will be enclosed in a plastic bag and secured to the inside lid of the cooler prior to shipment.

Upon receipt of the samples at the laboratory, the chain-of-custody form will be signed as received by the laboratory, and the conditions of the samples will be recorded on the form. The original chain-of-custody form will remain with the laboratory, and copies will be returned to the relinquishing party.

11.2 SAMPLE LABELING

Each sample obtained during the remedial excavation activities will be identified by a unique sample designation. The sample designation will be included on the sample label. The designation also will be included with the corresponding sample information on the appropriate field log. All samples will consist of three components separated by a hyphen. The sample designation scheme is as follows:

- Water Sample Designation Example: MW03-081506-W
 - MW03 = Monitoring well designation
 - 081506 = Date (YYMMDD)
 - W = Designation as a water sample

The designation “TB” will be used for field trip blanks and the designation “Dup” will be used for sample duplicates.

Sample information will be printed legibly on the sample labels in indelible ink. Field identification will be sufficient to enable cross reference with the project logbook. For chain-of-custody purposes, all QA/QC samples will be subject to the same custodial procedures and documentation as field samples.

To minimize handling of sample containers, labels will be completed before sample collection to the extent possible. The label will be filled out completely in the field and attached firmly to the sample container. The sample label will provide the following information:

- GeoEngineers’ job number
- Sample designation
- Date of sample collection (month/day/year)
- Time of sample collection (hours:minutes)
- Chemical analyses to be conducted
- Sample preservation, if applicable

- Initials of person obtaining the sample

12.0 DECONTAMINATION PROCEDURES

The objectives of decontamination procedures are to minimize the potential for cross-contamination between individual samples within a specific monitoring well, to prevent contamination from leaving the sampling site by way of equipment or personnel and to prevent exposure of field personnel to contaminated materials. This section discusses general decontamination procedures.

12.1 PERSONNEL

Personnel decontamination procedures depend on the level of protection specified for a given activity. The HASP identifies the appropriate level of protection for each type of field activity involved in this project, as well as appropriate decontamination procedures.

12.2 SAMPLING EQUIPMENT

Decontamination procedures are designed to remove trace-level contaminants from sampling equipment to prevent cross-contamination of samples. Nondedicated sampling or measurement equipment will be decontaminated prior to and after each sampling attempt or measurement by washing with nonphosphate detergent solution (Alconox and distilled water) and rinsing with distilled water.

13.0 PURGE WATER STORAGE AND DISPOSAL

Purge water generated from the groundwater sampling will be contained in 55-gallon steel drums and temporarily stored in a secured location at the Site (currently at the Washington State Department of Transportation [WSDOT] stormwater ponds). The drums will be labeled appropriately and covered with plastic. Chemical analytical results from the groundwater sample analysis will be used to characterize the purge water for disposal at an appropriate off-site disposal facility.

14.0 QUALITY ASSURANCE/QUALITY CONTROL

14.1 QUALITY ASSURANCE OBJECTIVES

The general QA objectives for this project are to develop and implement procedures for obtaining and evaluating data of a specified quality that can be used to assess site conditions and risks. Measurement data should have an appropriate degree of accuracy and reproducibility; samples obtained should be representative of actual field conditions, and samples should be obtained, transported and analyzed using proper chain-of-custody procedures.

14.2 FIELD QA/QC PROCEDURES

Field QA/QC procedures to be followed include completing all appropriate sample documentation.

14.2.1 Sample Preservation and Containers

Samples will be kept in a cooler with ice before and during transport to the laboratory. The sampling extraction and analysis dates will be reviewed to confirm that extraction and analyses were completed within the recommended holding times, as specified by EPA protocol. Appropriate laboratory-assigned data qualifiers will be noted if holding times are exceeded or containers do not contain the appropriate sample preservation. Table 1 summarizes sample preservation and containers.

14.3 LABORATORY QA/QC PROCEDURES

The data quality objectives will be met in the laboratory by using established instrument calibration and sample handling procedures, analysis according to standard analytical methods and analysis of quality control samples. Laboratory QC will consist of analysis of field sample duplicates and blanks, surrogate spikes, method blanks (MB), duplicates, matrix spikes (MS) and matrix spike duplicates (MSD) and reporting of all data including holding times.

14.3.1 Equipment Calibration Procedures and Frequency

All instruments and equipment used by the laboratory will be operated, calibrated and maintained according to manufacturers' guidelines and recommendations. Operation, calibration and maintenance will be performed by personnel who have been properly trained in these procedures. A routine schedule and record of instrument calibration and maintenance will be kept on file at the laboratory.

14.3.2 Analytical Procedures

Samples will be analyzed according to analytical methods listed above in Section 5.0. EPA standard analytical methods are specified in *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods SW-846* (through update III), dated December 1996. Washington analytical methods for petroleum hydrocarbons are specified in the MTCA regulations, as outlined in Chapter 173-340 WAC.

14.3.3 Laboratory QA/QC Samples

Laboratory QC samples will be analyzed at a frequency of 1 in 20 (5 percent) on a laboratory batch basis. Laboratory QC samples will consist of duplicates, MB, MS and MSD. In addition, each organic analysis will include addition of surrogate compounds to the sample for surrogate spike analysis.

14.3.4 Laboratory Deliverables

The following information will be provided in the laboratory reports submitted for this project:

- Transmittal letter, including information about the receipt of samples, the testing methodology performed, any deviations from the required procedures, any problems encountered in the analysis of the samples, any problems meeting the method holding times or laboratory control limits, and any corrective actions taken by the laboratory relative to the quality of the data contained in the report.
- Sample analytical results, including sampling date, date of sample extraction or preparation, date of sample analysis, dilution factors and test method identification, water sample results in mg/L or micrograms per liter ($\mu\text{g/L}$) and detection limits for undetected analytes. Results will be reported for all field samples, including field duplicates and blanks submitted for analysis.
- Method blank results, including reporting limits for undetected analytes.
- Surrogate recovery results and corresponding control limits for samples and MB (organic analyses only).
- MS/MSD and/or blank spike/blank spike duplicate concentrations, percent recoveries, relative percent differences (RPDs) and corresponding control limits.
- Laboratory duplicate results for inorganic analyses, including RPDs and corresponding control limits.

- Sample chain-of-custody documentation.

The raw analytical data, including calibration curves, instrument calibration data, data calculation work sheets and other laboratory support data for samples from this project will be compiled and kept on file at the laboratory's office for reference.

14.4 REVIEW OF FIELD AND LABORATORY QA/QC DATA

The sample data and the field and laboratory QA/QC results will be evaluated for acceptability with respect to the CMP data quality objectives (DQOs) as shown in Table 2. Each group of samples will be compared with the DQOs and evaluated using data validation guidelines contained in the following documents:

- "Guidance Document for the Assessment of RCRA Environmental Data Quality," draft dated 1988; and
- "National Functional Guidelines for Organic Data Review," draft dated 1999.

Data evaluation will include assessment of the criteria listed in Section 14.5.

14.5 PRECISION, ACCURACY AND COMPLETENESS

14.5.1 Precision

Precision is a measure of data variability. Variability can be attributed to sampling activities and/or chemical analysis. RPD is used to assess the precision of the sampling and analytical method and is calculated as follows:

$$RPD = 100[(X_s - X_d)/(X_s + X_d)]/2$$

where

RPD = relative percent difference

X_s = sample analytical result

X_d = duplicate sample analytical result

14.5.2 Accuracy

Accuracy is a measure of the error between chemical analytical results and the true sample concentrations. Accuracy is a measure of the bias in a system and will be expressed as the percent recovery of spiked samples. The accuracy will be calculated as follows:

$$PR = 100(X_{ss} - X_s)/T$$

where

PR = percent recovery

X_{ss} = spike sample analytical result

X_s = sample analytical result

T = known spike concentration

14.5.3 Completeness

Completeness is evaluated to assess whether a sufficient amount of valid data is obtained. Completeness is described as the ratio of acceptable measurements to the total planned measurements. Completeness is calculated as follows:

$$C = (\text{Number of samples having acceptable data}) / (\text{total number of samples analyzed}) \times 100\%$$

where

C = completeness

14.6 REPORTING, DOCUMENTATION, DATA REDUCTION AND CORRECTIVE ACTION

Upon receipt of each laboratory data package, data will be evaluated against the criteria outlined in the previous sections. Any deviation from the established criteria will be noted, and the data will be qualified as appropriate. A review and discussion of analytical data QA/QC will be included in the groundwater monitoring report. Data validation procedures for all samples will include checking the following, when appropriate.

- Holding times
- Detection limits
- Laboratory blanks
- Laboratory matrix spikes
- Laboratory matrix spike duplicates
- Laboratory blank spikes
- Laboratory blank spike duplicates
- Surrogate recoveries

If significant QA problems are encountered, appropriate corrective action as determined by GeoEngineers' project manager and/or the chemical analytical laboratory will be implemented as appropriate. All corrective action will be defensible, and the corrected data will be qualified.

15.0 REFERENCES

EPA. October 1988. *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Interim Final*. OSWER Directive 9355.3-01. EPA/540/G-89/004.

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Managers*. August.

TABLE 1
SAMPLE CONTAINERS, PRESERVATION AND HOLDING TIME
 BNSF OIL PIPELINE SITE
 TACOMA, WASHINGTON

Analysis	Method	Water			
		Minimum Sample Size	Sample Containers	Sample Preservation	Holding Times
cPAHs	GC/MS with high volume injection	1L	1 liter amber glass with Teflon-lined lid	Cool 4°C	7 days to extraction
Diesel-Range Petroleum Hydrocarbons	NWTPH-Dx, Calibrated to Bunker-C	1 L	1 liter amber glass with Teflon-lined lid	Cool 4°C, HCl to pH < 2	14 days to extraction

Notes:

Holding times are based on elapsed time from date of collection.

HCl = Hydrochloric Acid

L = liter

cPAHs = carcinogenic polycyclic aromatic hydrocarbons

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TABLE 2
DATA QUALITY OBJECTIVES
BNSF OIL PIPELINE SITE
TACOMA, WASHINGTON

Laboratory Analysis	Reference Method	Check Standard (LCS) %R Limits ^{2,3}	Matrix Spike (MS) %R Limits ^{2,3}	Surrogate Standards (SS) %R Limits ^{1,2,3}	Duplicate Samples MSD or Lab Duplicate RPD Limits ⁴	Field Duplicate Samples RPD Limits ⁴
		Water	Water		Water	Water
cPAHs	SW-846 8270C-SIM	50%-150%	50%-150%	20%-135%	20%	35%
Diesel-Range Petroleum Hydrocarbons	NWTPH-Dx	50%-150%	50%-150%	50%-150%	20%	35%

Notes:

¹ Individual surrogate recoveries are compound-specific.

² Recovery Ranges are estimates. Actual ranges will be provided by the laboratory when contracted.

³ Percent Recovery (%R) Limits are expressed as ranges based on laboratory control limits. Limits will vary for individual analytes.

⁴ RPD control limits are applicable only if the concentrations are greater than 5 times the method reporting limit (MRL). For results less than 5 times the MRL, the difference between the sample and duplicate must be less than 2 times the MRL for soil and 1 times the MRL for water.

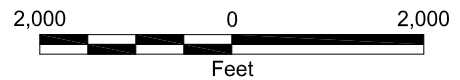
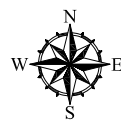
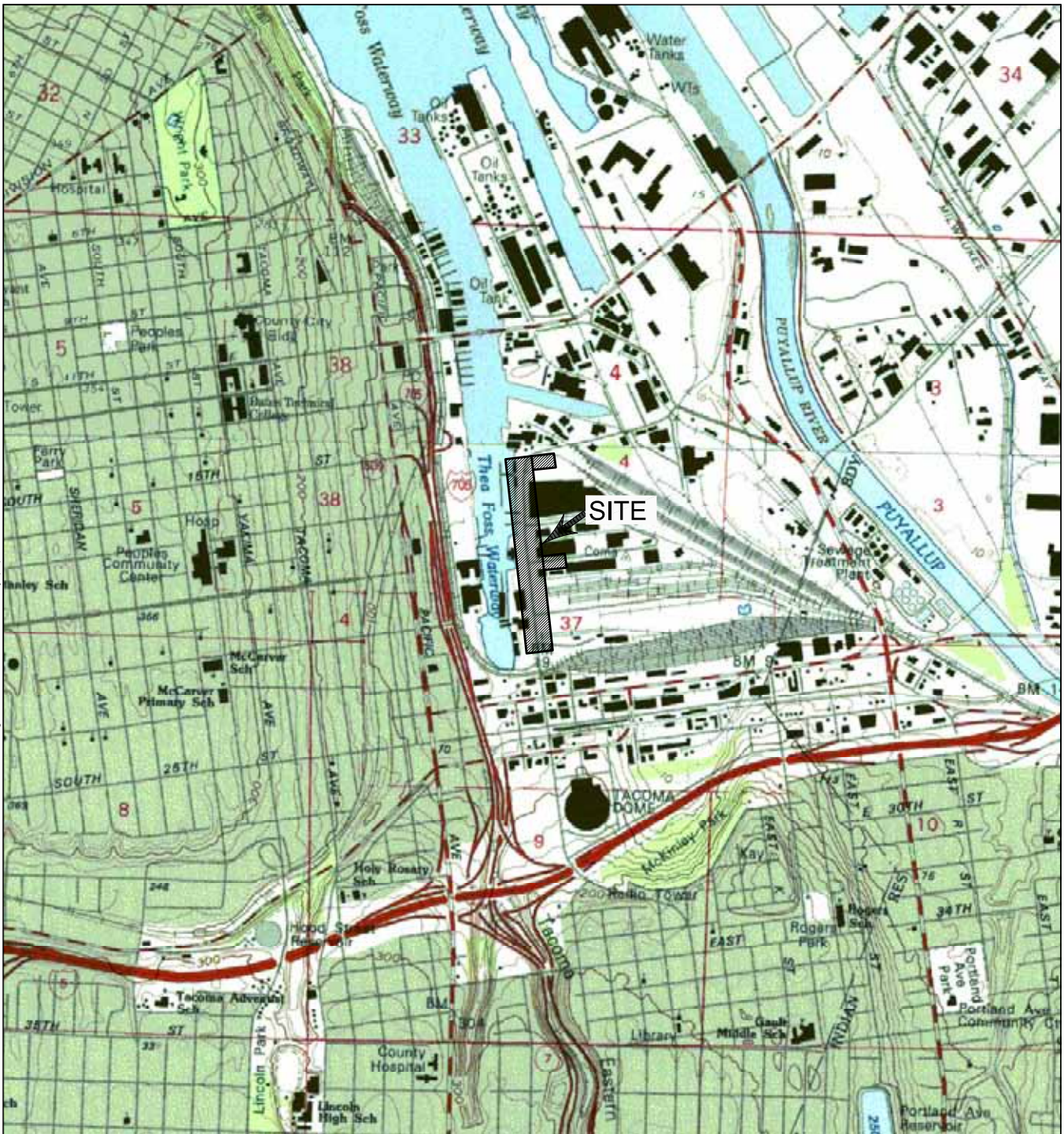
cPAHs = carcinogenic polycyclic aromatic hydrocarbons

LCS = Laboratory Control Sample

MS/MSD = Matrix Spike/Matrix Spike Duplicate

RPD = Relative Percent Difference

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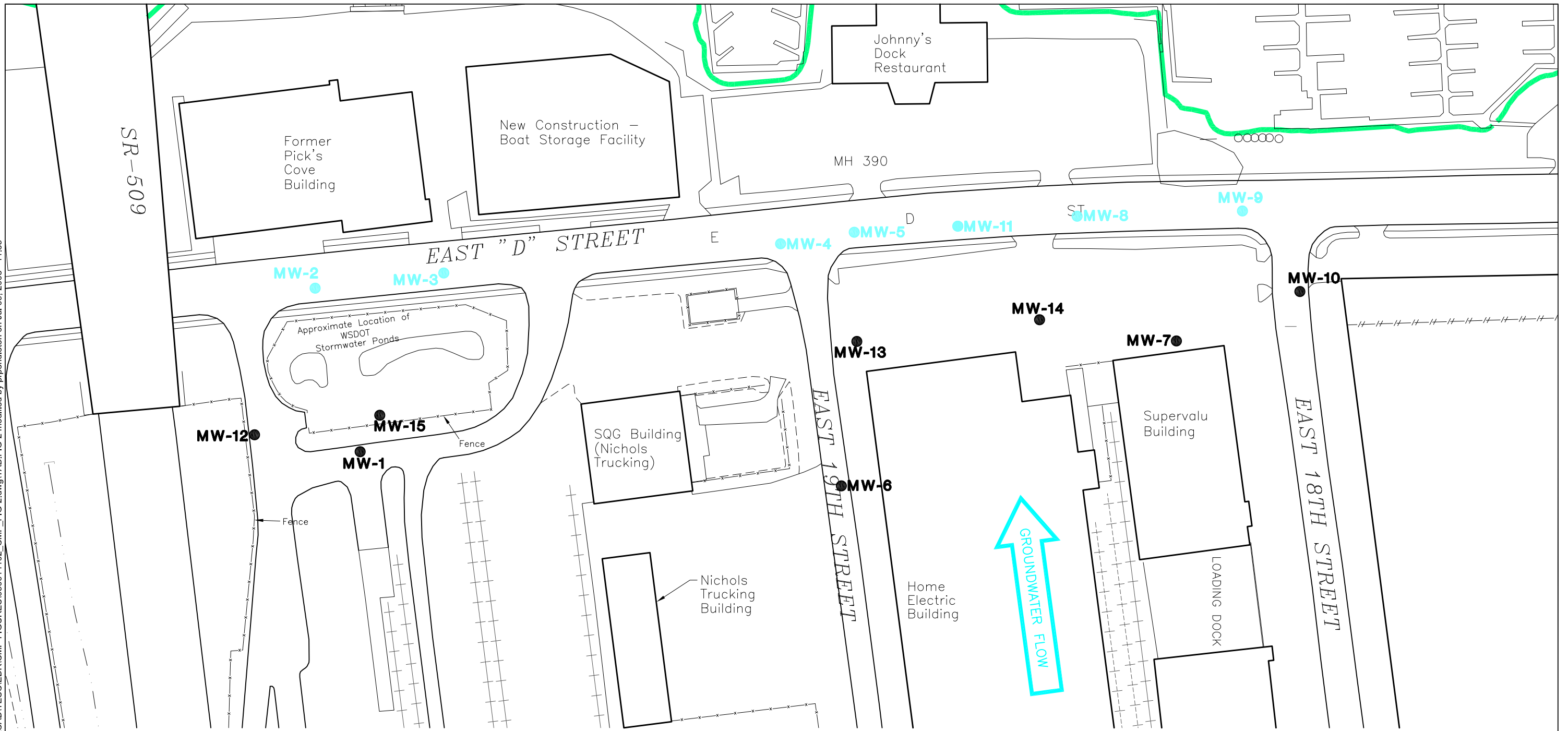
Notes:

- 1. The locations of all features shown are approximate.
- 2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Reference: Sure Maps! Raster Maps- USGS based quadrangles.

Vicinity Map	
Compliance Monitoring Plan	
BNSF Oil Pipeline Site (D Street)	
Tacoma, Washington	
GEOENGINEERS	Figure 1

P:\0050614\102\CAD\TSC\EDR\CMP FIGURES\050614\102_CMP_FIG-2.dwg\TAB:FIG-2 modified by pprenton on Jul 09, 2008 - 11:35
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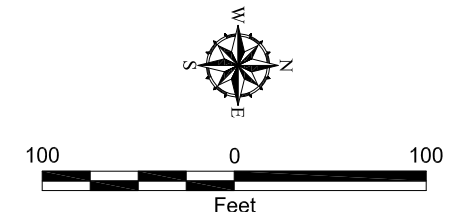


EXPLANATION:

- MW-1** ● MONITORING WELL
- MW-5** ● MONITORING WELL LOCATION AT THE CONDITIONAL POINTS OF COMPLIANCE
- THEA FOSS SHORELINE

Notes:
 1. The locations of all features shown are approximate.
 2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Reference: Drawing created from AutoCAD file, "E.D st-oil line-b.DWG", provided by City of Tacoma.



Monitoring Well Locations Compliance Monitoring Plan	
BNSF Oil Pipeline Site (D Street) Tacoma, Washington	
GEOENGINEERS	Figure 2



APPENDIX G
INSTITUTIONAL CONTROLS PLAN



**INSTITUTIONAL CONTROLS PLAN
ENGINEERING DESIGN REPORT
BNSF OIL PIPELINE SITE
TACOMA, WASHINGTON
FOR
BNSF RAILWAY COMPANY**

1.0 INTRODUCTION

Institutional controls are administrative measures that are intended to limit the potential for exposure to contamination by limiting site access and activities. Institutional controls are required where contamination at concentrations greater than cleanup levels will remain on the BNSF Railway Company (BNSF) Oil Pipeline Site (Site) in Tacoma, Washington. Institutional controls will be required for this Site in any areas where remediation to cleanup levels is impractical because of the presence of buildings, roads, utilities or other significant facilities.

2.0 DEED RESTRICTIONS

Deed restrictions will consist of the following:

- Deed restrictions (environmental covenants) that would mandate specific procedures for handling of excavation spoils or water from dewatering activities to prevent human exposure or harm to the environment during any future activities that disturb the subsurface and may potentially expose bunker-range petroleum hydrocarbons (BRPH)¹-contaminated soil and/or groundwater.
- Deed restrictions that would prohibit the installation of wells for use as a water supply. Although groundwater in the Site area is not potable because of its high salinity and Total Dissolved Solids (TDS) concentrations, the restriction would still be necessary to prevent uncontrolled withdrawals.
- Deed restrictions that would prohibit transfer of properties to another owner without notification to the Washington State Department of Ecology (Ecology).

3.0 ACCESS LIMITATIONS

Access to BRPH-contaminated soil remaining on the Site after completion of the remedial activities will be limited by the overlying clean soil cover, buildings, pavement and stormwater ponds and/or by fencing.

4.0 ZONING

Existing zoning at the Site is sufficient to limit property usage to minimize any potential future environmental exposure, and the deed restrictions described above would be sufficient to trigger Ecology notification if there was a future petition for a zoning change.

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¹ BRPH is a site-specific term indicating a Bunker C petroleum product with both diesel- and oil-range petroleum hydrocarbons. The concentration of BRPH as discussed in this report indicates either: 1) the sum of the laboratory reported concentrations of diesel- and oil-range petroleum hydrocarbons; or 2) the concentration of petroleum hydrocarbons quantified during analysis relative to a Bunker C product laboratory standard.